SCIENTIFIC AMERICAN

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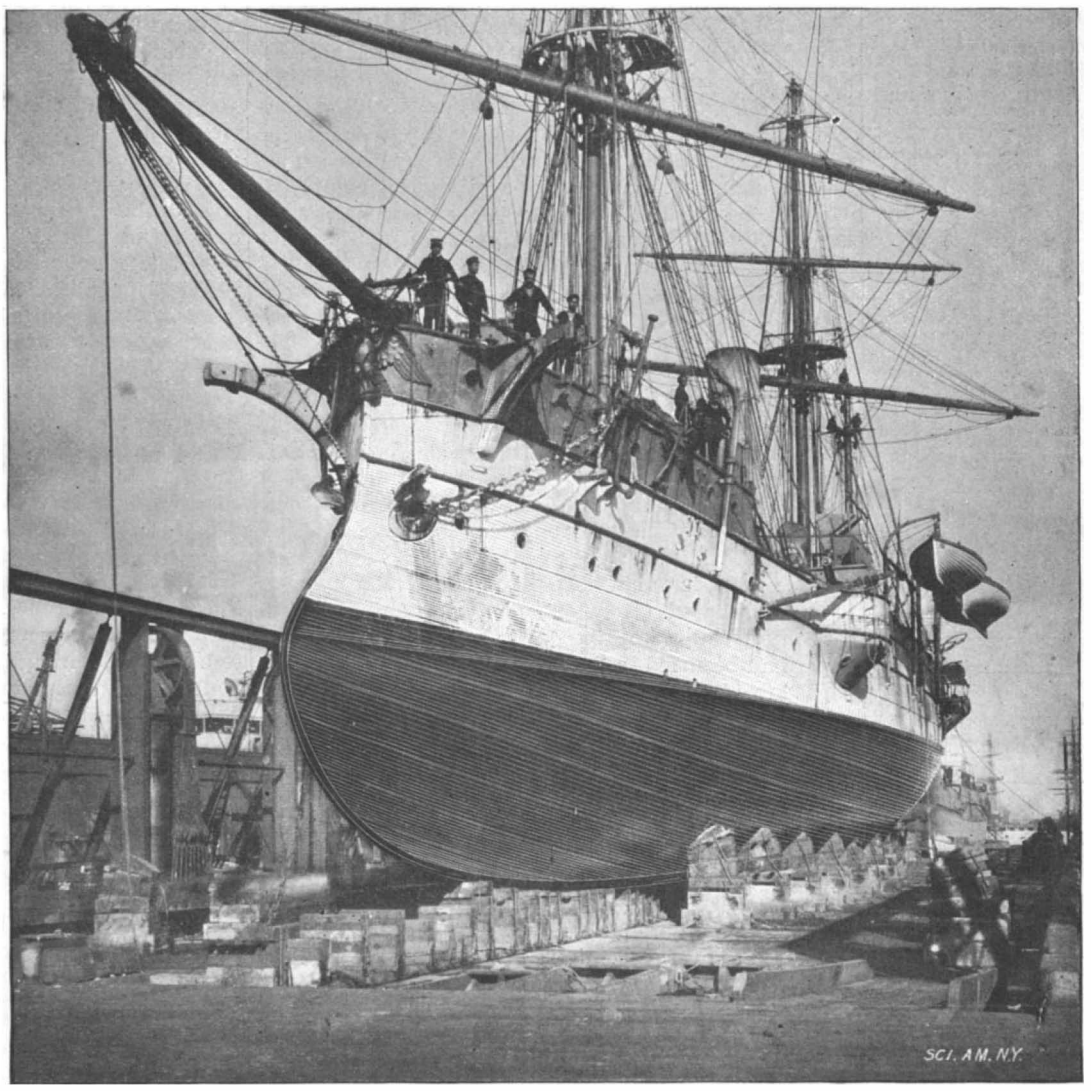
HYDRAULIC LIFT DRY DOCK AT THE UNION IRON WORKS, SAN FRANCISCO.

We present a series of views of a hydraulic lift dry dock, which has many features of novelty. It was designed, built, and erected by the Union Iron Works, for their own use, and forms a conspicuous feature at their fine yard in South San Francisco. The dock was designed with a view to securing: minimum cost of construction; expenditure of power and time in proportion to the vessel to be raised; rapid cleaning and painting of a ship's bottom; convenience in handling heavy weights, such as propellers or propeller blades, which, when the platform is raised level with the wharf, can be run onto the platform on low trucks.

The construction of the platform is simple and unique, consisting of a series of steel girders; one center longitudinal girder having a depth of 6 feet 4 inches, forming the keel, with two girders on each side of the keel, running parallel to it; the two outer girders having a depth of 5 feet. The five longitudinals are tied together by thirty-six transverse girders, having the full depth of the keel at the center, and a depth of 2 feet 10 inches at the ends, the whole being securely riveted together, having heavy angle irons at the corners. Over the whole platform is built a flooring for the men to work upon.



THE ZARAGOZA, FLAGSHIP OF THE MEXICAN NAVY, ON THE UNION IRON WORKS DRY DOCK, SAN FRANCISCO.

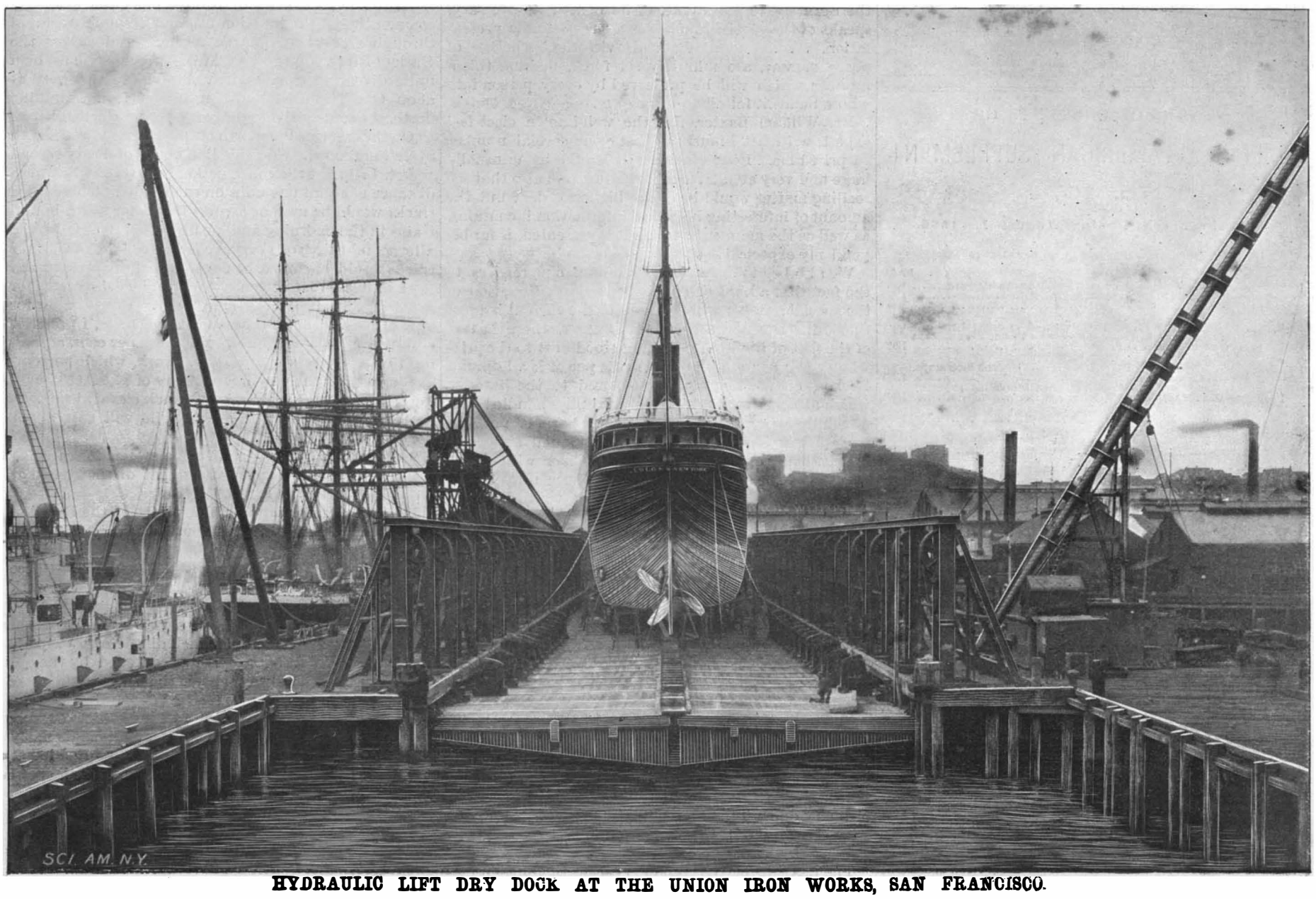
Immediately over the center girder or keel are built the keel blocks, with a length of 3 feet. On each of the transverse girders are built the bilge blocks, supported in position against the side of the ship by a pawl engaging a rack. The bilge blocks are placed in their respective positions by ropes in the usual way. The length of the platform on the keel is 436 feet 6 inches and the width is 65 feet 7 inches.

This platform is carried by thirty-six cast iron rams 30·7 inches diameter, having a lift of 14 feet 6 inches, eighteen on each side of the dock.

On the upper end of the ram is carried a sheave 6 feet in diameter, grooved for eight 2 inch diameter steel wire ropes. One end of the ropes is attached to the platform, then passed over the sheave, and the other end is secured to the base castings of the ram, which are stationary. This arrangement gives 2 feet lift of platform to 1 foot lift of ram. There are two piers of piles to support each ram, constructed as follows:

A steel casing 50 inches internal diameter was constructed long enough to have its lower end several feet in

(Continued on page 120.)



HYDRAULIC LIFT DRY DOCK AT THE UNION IRON WORKS, SAN FRANCISCO.

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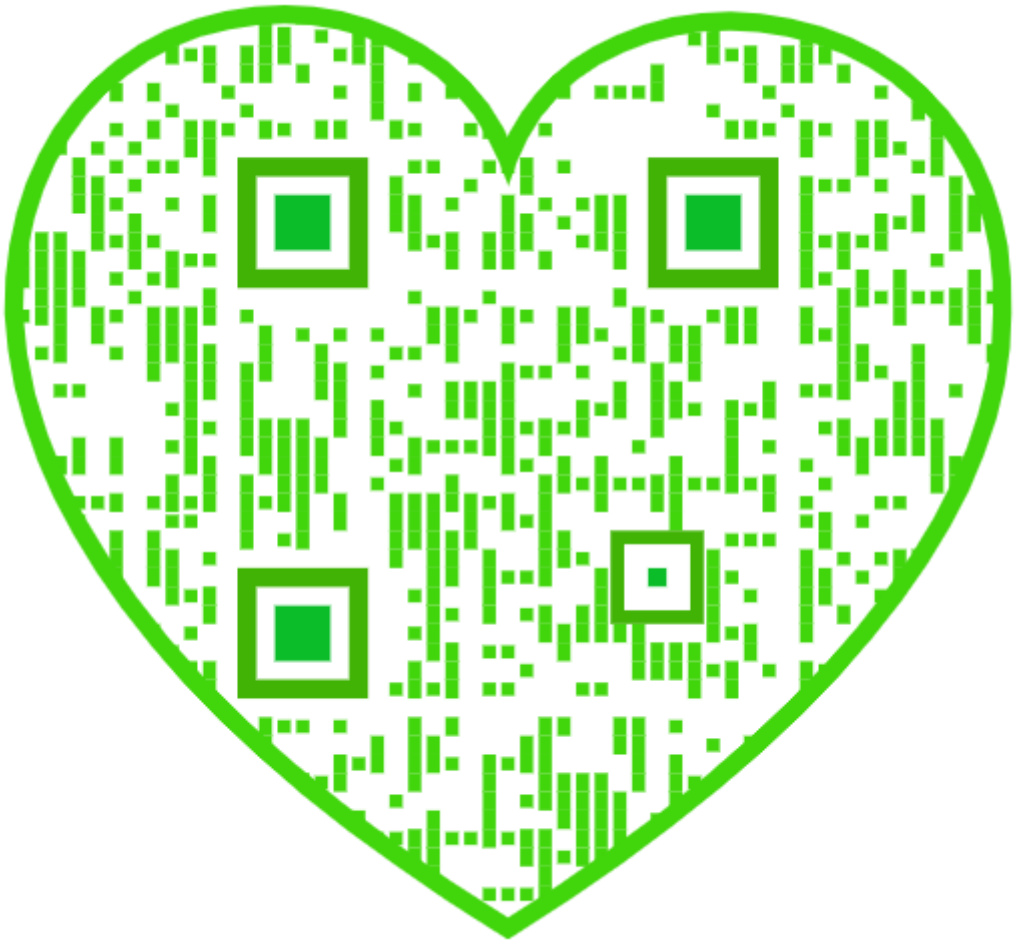

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OUR FIFTIETH ANNIVERSARY NUMBER.

After the work and anxiety of getting out a special anniversary number, it is with genuine pleasure that we are able to record its very favorable reception by our subscribers and readers. It occurs to the editor, as he sits reflecting in his chair, that a few "facts and figures" from the publishing department, showing the amount of time and material consumed in "getting out" a special edition, will be timely and of interest.

We will assume that all the editorial work has been completed; and that the proof sheets have been pleased with their final corrections in the printer's hands.

For the work of printing, three separate establishments were employed, and eighteen presses were set in motion. For two long weeks, day and night without intermission, the paper was fed to the machines and the services of over a hundred men were required to keep the work going. Three other establishments were employed steadily every day for two weeks on the binding and mailing, a work which kept seventy people and eight folding machines continuously employed. We have not included the immense amount of preliminary skilled labor that has been expended on the work, as, for example, the preparation of the drawings, engravings and half-tones, the latter passing through the hands of some twenty men before they are turned out ready to be placed on the press.

It required 78½ tons of paper to print this edition. Expressed in such terms this looks like a very large amount; but a more impressive idea of the amount of material handled is gained when it is expressed in terms of length. Eight pages of press matter constitute a form, and these eight pages are printed at one revolution of the press on a sheet of paper nearly four feet in width. If the printing had been done on a single press, it would have taken nearly nine months to have printed the whole edition, running at full capacity during a working day of ten hours; and if the paper had been fed to the press in a single sheet, four pages in width, it would have been over 470 miles in length. If the single page sheets of this edition were placed end to end, and strung out in a continuous line, there would be enough material to form an unbroken carpet from New York to the Mississippi Valley, or enough pages of reading matter to stretch from the Atlantic to the Pacific!

When the printing and binding are both completed, the mere task of mailing is far greater than our readers would commonly suppose. One day's mailing alone amounted to over eleven tons in weight, and filled two hundred and sixty mail sacks of the larger size.

Among other metropolitan contemporaries that have extended their fraternal greeting, the New York Sun welcomes the SCIENTIFIC AMERICAN anniversary number with its "articles on the various chief subjects of inventive thought by competent writers."

The New York World, in noting the attainment by the SCIENTIFIC AMERICAN of its fiftieth anniversary, speaks of the special number as a "remarkable presentation. . . . The mechanical 'victories,' whether of peace or war, are minutely set forth, making this a number which will be preserved by every person into whose hands it falls."

Mr. William Baxter, Jr., the well-known electrical expert, writes: "I must say that your special number surprised me. I expected that it would be unusually large and very attractive in its get-up, and also that the reading matter would be of the highest order; but the amount of interesting historical information it contains, as well as the manner in which it is presented, is far beyond my expectations."

We also beg to draw the attention of our readers to the fact that a kind of supplementary continuation of the special number will be found in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT, where the text of the first of the five essays that stood next to the prize winner will be found. It is from the pen of Mr. Edmund Becker, of Washington, D. C., and to the interest which attaches to a subject thoughtfully handled and forcefully expressed, it adds a strong charm of novelty, inasmuch as it is written in the colloquial style, and is entitled, "1846 has an Hour's Chat with 1896." An old gentleman and a young engineer meet at the Fifth Avenue Hotel, New York, and it transpires that the former, as the result of a shipwreck, has spent the past forty-nine years in the seclusion of a solitary isle. They are both graduates of the Rensselaer Institute, and naturally settle down to a comparison of then and now.

The essay is racy, readable and highly creditable to its author.

THE NEW PLAN OF THE RAPID TRANSIT COMMISSION OF NEW YORK CITY.

The provision of rapid transit for New York City has an interest which extends beyond the limits of the city itself. The peculiar nature of the site upon which the city is built—a narrow and long-drawn-out peninsula, with its great business center located at its extreme end—renders the transportation problem one of more than ordinary difficulty, and its solution is being watched with great interest by the country at large, and particularly by all municipal engineers.

The meeting of the Rapid Transit Commission, on the 16th ult., was marked by two important events: the statement by Mr. Gould of the latest scheme of extension of the Manhattan elevated roads, and the presentation of an amended plan for an underground tunnel by the chief engineer of the commission. The proposals of the Manhattan Company may be dismissed with the announcement that the much talked of extension of the system into the annexed districts north of the Harlem River has dwindled down to a proposal to build certain surface trolley lines to connect with the present elevated system, and that this poverty-stricken proposal is saddled with a demand that such roads, if built, shall be guaranteed against all claims for land damages. The lavish promises which were made to the mayor of the city, at the time that the appellate justices had the competitive rapid transit scheme under advisement, have certainly shrunk to a very small measure. From the construction of express elevated roads, running full sized trains, to the laying down of single car trolley lines, is a big drop, and probably no one was less surprised than the representatives of the Manhattan Company themselves that the commission gave the proposition a cool reception, and went into secret session to hear the amended scheme of their chief engineer for an underground tunnel.

The new plans have been prepared so that they shall be in conformity with the requirements of the law and the late ruling of the appellate justices, and, at the same time, avoid any conflicts with the interests, real or supposed, of the property owners. The main objections urged against the Broadway tunnel scheme were the cost, the invasion of the rights of property owners on Broadway, the interruption to traffic, and the fact that it involved subsurface travel. It will be seen from the extract from Mr. Parsons' report, given below, that the first three objections are removed by the adoption of the Elm Street route. There will be no interference with property owners, inasmuch as Elm Street is about to be opened through to Center Street and the City Hall Park, and the buildings on either side will be torn down, so that it can be widened. These improvements and the construction of the tunnel could be carried out simultaneously. The estimated cost—$26,500,000—is only 50 per cent of the total expenditure allowed by the law, and to those who object to underground travel it must be said that, judging from the events of the past few months, it begins to look as though the public would have to choose between a tunnel and nothing.

The report says: "I suggest a route commencing at the southwest corner of City Hall Park, with a station on Broadway. Thence with a two-track loop around the park, merging into one four-track road at Brooklyn Bridge. Thence northerly with four tracks under Elm Street and Fourth Avenue to Forty-second Street. Thence diverging with one two-track road under Forty-second Street to Broadway and under Broadway and the Boulevard to One Hundred and Thirty-fifth Street.

"Also an east side route to have one two-track road commencing at the junction at Forty-second Street and through and along Fourth Avenue and across the Harlem River, as proposed in the previous plans, or a route diverging from Fourth Avenue to the west at about One Hundred and Tenth Street, and running northerly across private property to the Harlem River.

"On the east side line, north of One Hundred and Tenth Street, and on the west side line north of Forty-second Street, I suggest the construction of a third track for a distance of about one mile on each route. These third tracks would be used as express tracks for south-bound trains in the morning and north-bound trains in the afternoon. South of Forty-second Street two of the four tracks would, of course, be devoted to the express trains.

"I estimate that such a system can be constructed for $21,000,000 exclusive of right of way. But to allow for unforeseen and not estimated contingencies, I prefer to add percentages varying from 20 to 40 per cent, according to the several sections of the work, which percentages aggregate the very liberal figure of $5,500,000, making a total of $26,500,000. A two-track elevated railroad north of the Harlem River, if built, will cost about $350,000 per mile.

"The physical capacity of such a system for carrying passengers would be as great as that of the system at first designed by the board."

In making this estimate, the prices of the Board of Experts, Messrs. Hewitt, Chanute, Clarke, Sooysmith and Burr, are used; and Mr. Parsons says that the cost of the recent tunnel work in Boston shows that these prices are very liberal, and that it is probable the work can be done for much less.

Regarding the speed of express trains, it is expected to make forty miles an hour, including stops. This is not too high an estimate. It was conceded by the opposition to the Broadway scheme that a speed of thirty-five miles an hour could be realized, and in view of the subsequent and continual improvement which is going on in motors and in methods of transmission, it is likely that by the time the scheme is completed—estimated at two years from the commencement of work—this speed can be reached or even exceeded.

IT is estimated that the Pan-American railway to the southern extremity of South America would extend about 4,500 miles and cost $180,000,000.

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SOME PHENOMENA OF THE ST. LOUIS HURRICANE.

A very spirited description of the formation and course of the late St. Louis storm was recently contributed by Mr. H. A. Kirchner, F.A.I.A., to the American Architect and Building News. The barometric readings for the day show a steady fall from 29·30 at 7 in the morning to 28·75 at 5:15 in the evening, when the storm was at its height. They were as follows:

7 A. M.	29·30	3 P. M.	29·10
8 "	29·28	4 "	29·05
9 "	29·27	5 "	29·00
10 "	29·26	5:15 "	28·75
11 "	29·25	6 "	29·10
12 M.	29·25	7 "	29·14
1 P. M.	29·23	9 "	29·16
2 "	29·16	10 "	29·13

The first evidence af the coming trouble occurred at noon, when there were signs of a storm gathering in the west. At 3 P. M. the northwestern sky was overcast; at 4:30 there was "a flying scud underlying light gray cumulus clouds," the wind was increasing and was from the east.

"At 4:35 the flying scud was traveling very rapidly from southeast to northwest, the sky in the south and southeast still remaining clear. The wind increased, still from the east, attaining a velocity of thirty-seven miles per hour. Every indication pointed to a catastrophe in the elements. The western sky became black, the scud piling up in high banks. Suddenly, at 5 P. M. a line formed on the northern sky, showing an attack by the elements from that direction. The line was moving rapidly to the south, forming a straight line from east to west, and mounting high into the sky, all underneath the rapidly advancing line of the storm being of a transparent green color. At the same time the moisture in the air over the city condensed into an inky blackness, from which issued magnificent bolts of lightning in bands of heroic size, setting fire to several buildings and destroying telephone boxes, power houses and light plants. The wind, blowing from east-northeast, suddenly increased to 120 miles per hour, tearing, ripping, demolishing everything in its path. Joists, scaffolding, tin roofs, trees, cornices, signs, glass, brick, every material, large and small, found in the country or city, seemed in grand conglomeration to move westward with a speed indescribable, amid the roaring, crashing, booming artillery of the onslaught of wind and water, the lightning lighting up the scene to only a few feet from the observer, as the elements were so thick as to obscure light. The effect was the same as sunshine when seen from under the water. This turmoil ceased after ten minutes' duration, when it set in again, more terrific than before, from the west-northwest, with an interval of but a few seconds. The second onslaught lasted about ten minutes. Twenty minutes after, a third storm, but with wind of moderate velocity (about 25 miles), set in, accompanied by severe lightning, hail and flood. Altogether over three inches of rain fell in one hour."

The effect of these storms was distinct, the one from the east wrecking the northeast part of the city and the river front, the second wrecking the southern and southwestern part of the city. The storm, however, was general, for severe damage was done throughout the city, and over an area of 150 square miles.

Mr. Kirchner is of the opinion that the storm was more of the nature of a hurricane than a tornado, although "undoubtedly derived from the same source as a tornado," both resulting from the unbalanced magnetic condition of the atmosphere. The damage, as assessed, amounts to some $20,000,000, and in the opinion of the writer was caused:

First. By the direct pressure resulting from the velocity—120 miles an hour—of the wind. This is estimated at 79 pounds per square foot of surface, normal to the direction of the storm. Secondly. The pressure of the wind was assisted by the impact of flying debris. These two causes would operate to bend the columns of a building of steel skeleton construction, throwing the wall out of plumb and causing the shell of brick or stonework to fall out of the framed work, as the combined result of shock and gravity. It is estimated that the total pressure upon a skeleton building of 50,000 square feet front, which the writer was constructing, amounted to 4,000,000 pounds. Thirdly. Telegraph poles would snap in two, and the cross trees and wreckage attached to telephone, telegraph, and electric wires swayed from side to side, knocking down buildings on each side of the street. Fourthly. Tin roofing was torn loose, and swept through the air, assisting in the general destruction.

It is suggested that these periodical storms should be made the object of special scientific study. It is certainly humiliating that with all our wonderful advance in science, and our ever increasing knowledge of natural phenomena, we should be so ignorant of the real cause, and so helpless in the presence of, such storms as this. In view of the appalling loss of life and property which attends these Mississippi valley storms, it would be both humane and prudent to make a special appropriation for their investigation. All possible data should be gathered regarding previous storms, and an effort made to find out the laws which govern, or at least the very earliest signs which foretell their approach.

THE THREE NEW BATTLESHIPS, NOS. 7, 8, 9.

The Naval Department has lost no time, since the appropriation of the necessary funds by Congress, in the preliminary arrangement for the construction of the authorized battleships, and the circular of the Secretary calling for bids is in the hands of the various builders. The contracts are to be made on or before October 8 of this year. Proposals will be received by the department either under its own plans and specications or under plans and specifications submitted by the bidder and approved by the Secretary of the Navy. The dimensions of the new ships are to be as follows: Length on water line, 368 feet; breadth, 72 feet; mean draught, 23½ feet; normal displacement, 11,500 tons; and they each carry a total of 1,200 tons of coal.

The armament will consist of four 13 inch guns, mounted in two 17 inch turrets, the barbettes being 15 inches thick. There will be a broadside battery of fourteen 6 inch rapid fire guns protected by a continuous wall of 5½ inch armor, extending in the wake of these guns from turret to turret. Between each 6 inch gun a 1½ inch splinter bulkhead will extend from deck to deck, serving to confine the flying fragments to one particular gun station. Disposed throughout the ship in commanding positions will be some twenty-five smaller rapid fire guns, consisting of sixteen 6 pounders, four 1 pounders, four machine guns and one field gun.

The hull is protected at the water line by a belt of steel 16½ inches in its thickest part and 7 feet 6 inches wide, 4 feet being below and 3 feet 6 inches above the water line. The 16½ inches thickness will be continuous from the aft to the forward barbette, and from the forward barbette to the bow it will gradually diminish to 4 inches. Athwartships, at the barbettes, there will be bulkheads of 12 inches of steel, to resist a raking fire by the enemy. This wall of armor will be roofed in by a protective deck of 2¾ inch steel which will be carried out to the bow and stern, and curved down to below the waterline at the sides, the thickness being increased to 3 inches at the bow and 5 inches at the stern. Below the bottom edge of the side armor the hull will be double, the space between the two shells being subdivided into watertight compartments.

There will be two military masts, each carrying two fighting tops, and the conning tower of 10 inch steel, which will be placed beneath the pilot house, will be supplemented by another armored position aft, from which the ship can be fought in case the first should be destroyed. The stability of these ships will be assisted by a complete belt of corn-pith cellulose—a substance which swells rapidly when wet and will automatically plug up shot holes—which will be worked in from stem to stern in the wake of the 6 inch armor. To reduce the fire risk, as little wood as possible will be used in the construction of the internal fittings of these ships. The speed is to be 16 knots and the cost is not to exceed $3,750,000.

It will be seen that the completion of Nos. 7, 8 and 9 will add a very formidable trio to our new navy. The designs are full of interest, and show that the naval board have made a compromise between the Iowa and Kearsarge type. They have departed from the Indiana in the matter of armament, by throwing out the 8 inch guns altogether, and substituting an extremely powerful battery of 6 inch rapid fire guns. The new type has the high freeboard of the Iowa; the forward heavy guns being located on the upper deck, which only extends back to the aft barbette, and the after pair being on the main deck. There are the same number of heavy rapid fire guns in the secondary battery as there are in the Kearsarge, but the caliber has been raised from 5 inches to 6 inches, and they are better disposed, ten being on the main deck and four on the upper deck. Though the number of guns in the heavy rapid fire battery is the same as in the Kearsarge, the increase of one inch in the caliber of these guns increases their power to such an extent that the total energy of one rapid fire broadside of the new ships will be about double one discharge of the corresponding battery on the Kearsarge. No doubt many admirers of the noble trio represented by the Indiana will regret the absence of the 8 inch guns, which were their characteristic feature; but the substitution of rapid fire is in the line of modern ideas on battleship building, and the actual weight of metal thrown by the new ships in a given time will be equal to, if not greater than, that of any ship afloat.

Sir John Pender.

Sir John Pender, to whom we are largely indebted for the first Atlantic cable, died on July 7, at the age of eighty-one. Had it not been for his generosity and faith in the cable scheme, we should undoubtedly have been deprived of the cable for many years. In 1857 he was one of the original stockholders. When the cable parted in 1865 the case seemed desperate; neither the public nor the government would help. Then Sir John came forward and pledged an enormous sum as a guarantee. It was largely due to him also that Australia and the East were put into telegraphic communication with Europe. His public services were unquestionable and many honors were bestowed on him.

Nest Building Fishes.

There are fishes that build nests just as birds do. Not long ago some of them were brought to this country from Japan, and the San Francisco Examiner says one can buy a pair of them for a small price at any fancier's now.

The habits of these creatures are remarkably interesting, and, unlike gold fish, they will breed in an aquarium or even in a glass globe. They produce three or four broods of young annually, so that the owner is likely to be able to make money by disposing of the increase. In the land of the Mikado, to which they are native, they are called paradise fishes.

The nests they make are very odd, indeed, being composed entirely of air bubbles. When the time for mating arrives the male fish undergoes a striking change in its appearance. Ordinarily he is of a dull, silvery color, but now he exhibits stripes of red, blue and green, with streaks of brightest orange on the ventral fins. Such is the costume in which he goes a-wooing.

Later on the female proceeds to construct the family nest at the surface of the water. Swallowing air, she ejects it in the shape of bubbles, which are held and made permanent by glutinous capsules from a secretion in her mouth. Having got together in this way a sufficient mass of bubbles, she proceeds to lay.

At this stage the female paradise fish seems always to be seized with a strange desire to gobble her own eggs. This she would inevitably do but for the watchfulness of the male, who prevents her, taking the eggs in his mouth and ejecting them beneath the mass of bubbles, to which they rise and find a resting place among them. Sometimes he will conduct his mate under the nest, so that the eggs as they are laid may ascend to it. When laying is finished he keeps guard over the nest, attacking the female if she comes near. Meanwhile he busies himself in the making of fresh bubbles to take the place of those which chance to burst.

This performance is kept up for five days, at the end of which the young are hatched out. They cannot swim, but cling like little tadpoles to the bubbles. If one falls to the bottom, as happens now and then, the papa fish takes it in his mouth and disgorges it among the bubbles again. His watchfulness is continued until the little fishes are able to take care of themselves.

They grow fast in a glass globe or aquarium, attaining a length of three or four inches. They thrive best on chopped angle worms, but raw beef cut fine will serve as a substitute. Apparently they are exclusively carnivorous. Care must be taken not to expose them to cold, which quickly kills them.

Plans for the Sandy Hook Station.

Plans have been prepared at the War Department for important improvements at the Sandy Hook military station, officially known as Fort Hancock, says the New York Tribune. These have been approved by Secretary Lamont, and the probabilities are that in the near future the work of building quarters and barracks at the station sufficient for the purposes of a fair sized army post will be begun. The plans drawn up contemplate the erection of a number of houses for officers and a barracks to accommodate about 100 men, and the making of suitable parade grounds, walks, roads, etc. These plans were prepared under the direction of the Quartermaster-General. It is proposed to make the buildings of brick, and to place in them all modern conveniences for the health and comfort of officers and men. In his last annual report General Miles said that Sandy Hook was an important military point, which, in time of war, would be a valuable outpost in the defense of New York. He recommended that steps be taken to make the place more formidable. Congress took up the subject, and in the army appropriation bill provision was made for quarters and barracks in connection with a permanent artillery garrison at Fort Hancock.

For this purpose Congress authorized the application of $100,000 of the total appropriation for the fortification and equipment of the new fort. It is expected that this money will suffice to provide what is known as a two battery post, and that will mean a garrison large enough to man the defensive works already constructed, although not sufficient for all future needs. Therefore the plans have been so projected as to permit of a ready extension of the quarters at any time. They have already been prepared, and the quartermaster's department will at once take steps to procure all further necessary information for beginning construction work. The projected work will not interfere in any manner with the completion of the defensive works of the fort itself, which is to be pressed as rapidly as the resources of the engineer's department and the capacity of the army ordnance works will permit.

Much has already been accomplished at Sandy Hook that is unknown to the public in the matter of placing mortar batteries, and there are also several heavy caliber modern rifles there mounted on disappearing carriages. The ordnance shops are making rapid progress with other heavy guns, and it is expected that considerable additions will be made to the Fort Hancock defenses as soon as the engineers can prepare the emplacements, possibly this summer or fall.

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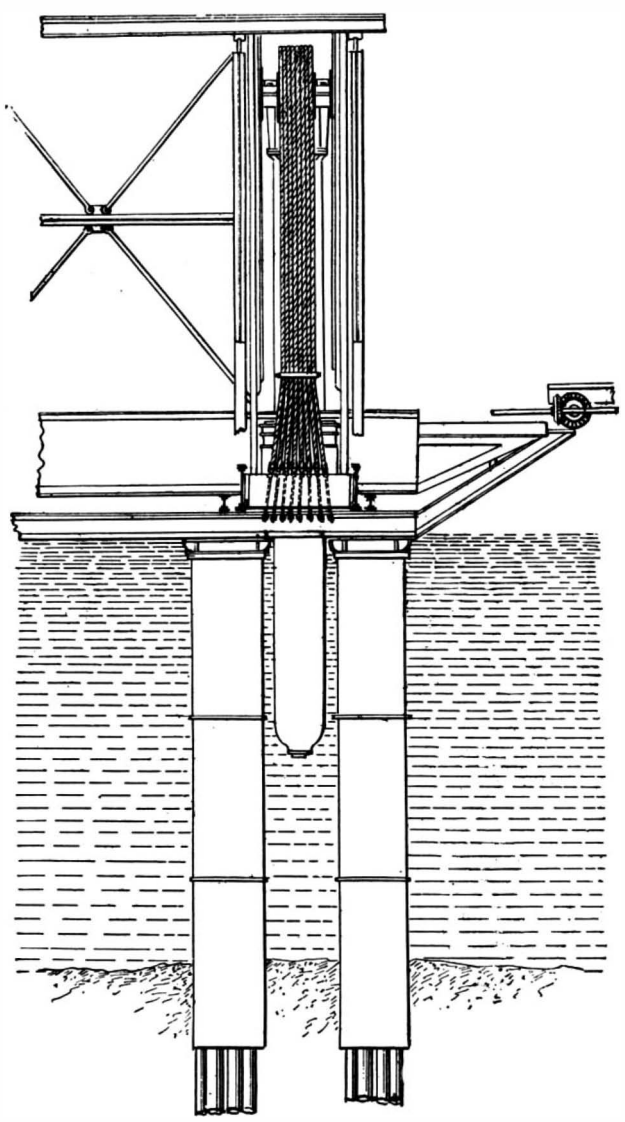
HYDRAULIC LIFT DRY DOCK AT THE UNION IRON WORKS, SAN FRANCISCO.

(Continued from first page.)

the mud, as shown in end view, with its upper end about water level at mean high tide. This casing was filled with piles 100 feet long, seven to each pier, all leveled off even with top of casing, and the whole capped with a cast iron cap. Each pier is capable of sustaining a weight of eighty-two tons, giving a capacity of 164 tons to each ram.

Running longitudinally and supported on the cast iron caps are two steel girders, with a depth of 18 inches, which directly support the ram cylinders, as will be plainly seen by reference to the end view. To balance the twisting tendency of the transverse girders on the piers, cantilevers were extended out 28 feet from each side of the dock and the ends anchored to two piles for each lever, two levers being used for each ram, or a total of 72 levers.

The equalizing device for the rams is an ingenious affair and exceedingly simple in its operation; each ram being its own governor. The supply pipe, D, for the rams extends along two sides and across one end of the dock, connecting with the accumulator in the pump house. The relief pipe, E, extends over the same course, and discharges back into the supply tank on the roof of the pump house. At the top end of each plunger there is placed a double hydraulic valve, A, with a pipe, B, connected to each one, and telescoping into pipe, C, that extends under water alongside the piers and draws its supply from the main line, D.



UNION IRON WORKS HYDRAULIC DRY DOCK—SIDE VIEW OF LIFTING RAMS AND PIERS.

At the valve, A, a lever, F, is carried, with its fulcrum equidistant from the center of each valve stem, one being the inlet and the other being the outlet, while the end of the lever engages a nut, G, carried on a vertical screw connecting with a line of shafting surrounding three sides of the dock, and operated by a pair of 6 inches by 6 inches vertical engines placed in the pump house for that purpose alone.

It will be plainly seen, as the nut travels upward on the screw, the lever opens the inner valve and allows the water to flow into the cylinder, thereby raising the plunger until it brings the lever on a level and shutting off its own supply, causing the plunger to follow the nut on the screw. By this means a ship is raised on one end of the platform, with perfect safety, while the other end is unoccupied, all the while the dock being kept on an even keel.

In the pump house, for supplying power to raise the dock, are two 12 inches by 16 inches vertical steam engines, with 90 pounds steam pressure, connected by pinion and gear to four horizontal pressure pumps, 3¾ inches diameter of plungers, 36 inches stroke, running at an average of 31 strokes per minute, and discharging into an accumulator, whose ram is 8 inches diameter by 48 inches stroke with a total weight of 62,000 pounds. From the accumulator the water passes into the rams, under control of the valve mechanism. The accumulator has detachable weights that are added according to the weight of the ship to be balanced in raising, as the operation is simply a case of balance between the ship and accumulator.

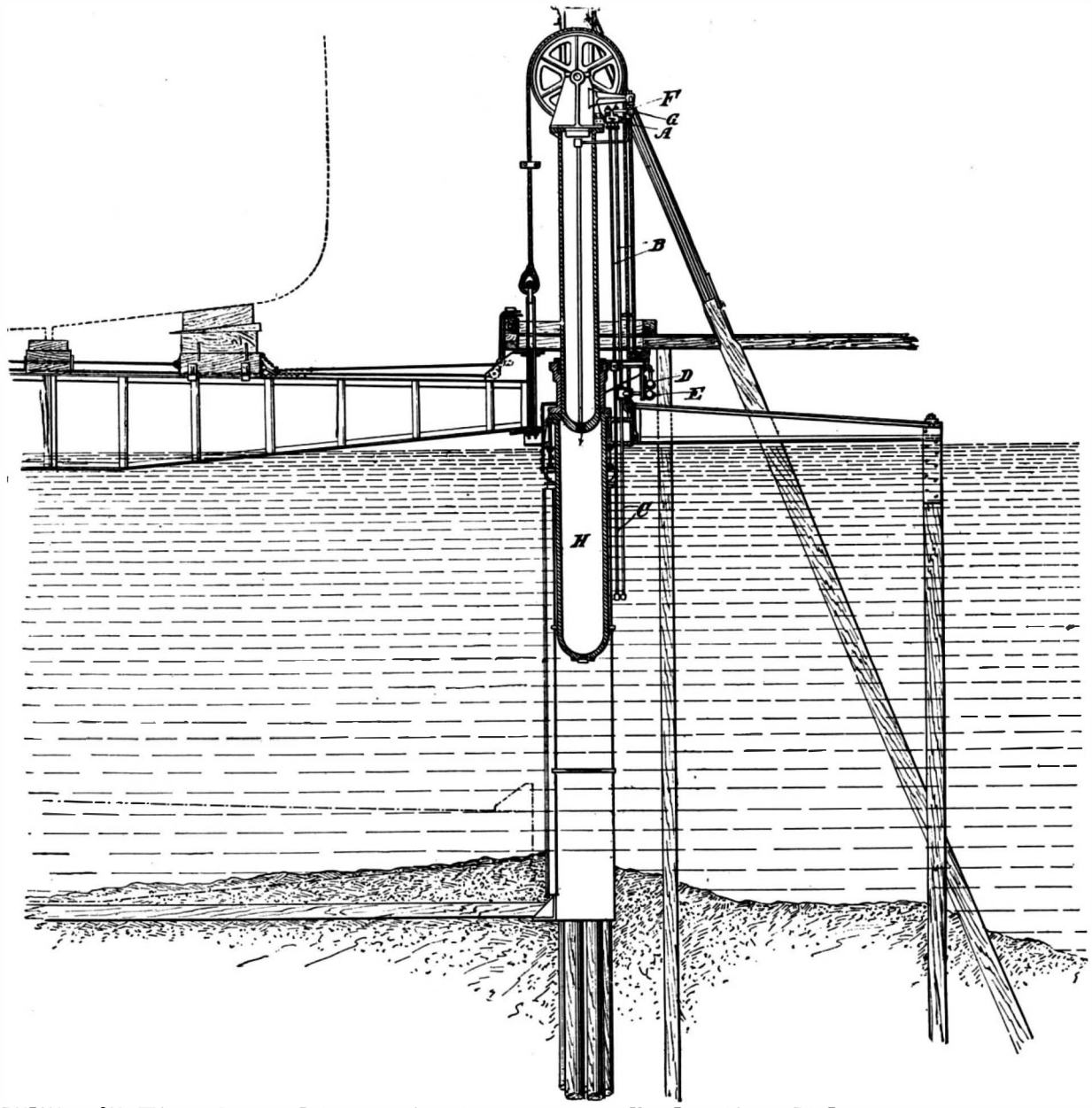
The throttle valve of the pump engines is connected to the accumulator, so that whatever leakage takes place in the pipes is constantly kept supplied automatically without any attention.

When the dock is raised a series of locks on each side are run under the platform by hydraulic rams, and the platform is allowed to settle upon them and relieve the ropes and rams from the weight.

The dock has been in successful and constant operation since 1887, and has a record for number of ships docked that is rarely equaled. Considering the novelty and boldness of the design, and the reliable service that it has rendered, this is a piece of engineering which is entitled to the greatest credit.

Some of the principal dimensions are as follows:

Total length of girder	421 feet 7 inches
Total length of platform on keel	436 " 6 "
Width of platform	65 " 7 "
Maximum lift	29 "
Maximum lifting capacity	6,000 tons
" " " per ram	164 "
Number of rams	36
Diameter plungers	30·7 inches
Eight 2 inch diameter steel ropes per ram.	



UNION IRON WORKS HYDRAULIC DRY DOCK—CROSS SECTION, SHOWING CONSTRUCTION OF RAMS AND GIRDERS OF PLATFORM.

Two 12 inch by 16 inch vertical steam engines for pumps.	
Four pressure pumps, 36 inch stroke, diameter of plungers, 3¾ inches.	
One Worthington duplex pressure pump, 4½ by 1¾ by 4 inches.	
One accumulator, 8 inch diameter by 48 inch stroke.	
Weight on ram	12,000 lbs.
" of eleven pieces of weights	47,500 "
" of ram	2,500 "
Total weight of accumulator,	62,000 "
Average speed of pressure pumps, 31 strokes per minute.	
Pressure of lifting empty dock	275 lbs. per square inch
" " loaded dock	1,250 " " " "
Speed of platform, loaded	3·2 inches per minute, 1,250 lbs. per square inch
Steam pressure	90 lbs. per square inch

VESSELS RAISED ON DRY DOCK OF UNION IRON WORKS.

Year.	Number vessels.	Tonnage.
1887	48	56,634
1888	114	112,167
1889	120	129,828
1890	132	113,738
1891	154	157,082
1892	131	144,544
1893	122	169,343
1894	107	141,587
1895	112	154,414
1896 to May 2	32	43,578
	1,072	1,228,695

This is equal to about 10·1 vessels per month.

Platinotype Effects on Gelatino-chloride Paper.

A correspondent of the Photographic News suggests the following:

A pure platinum black cannot be obtained by using a gold toning solution.

A very near approach to it, however, can be secured by using the ordinary sulphocyanide bath.

Sulphocyanide of ammonia	30 grains.
Gold chloride	2 "
Water	16 ounces.

When toning, examine the prints from time to time by holding them up to the light and looking through them.

Toning is complete when the warm tones have disappeared, except from the darkest portions of the print, which should appear of a deep chocolate brown.

At this point transfer the prints to a dish of clean water and wash for a few minutes.

On placing in the fixing solution the prints will turn slightly warmer in tone, but will become darker when finished and dried. When the prints have been fixed and thoroughly washed they are ready for finishing.

Take a piece of finely ground glass such as is used for focusing screens. Wash well with soap and water, wipe perfectly dry, and rub lightly with a soft cloth and powdered talc.

Dust off the superfluous talc; wipe the edges and back of glass clean. Place the glass in a dish and cover with water.

Take up a print and wash the surface with a small sponge, using plenty of water. This is to free the surface from any particles of grit or dirt which may be adhering to it.

Float the print on to the ground glass under water, taking care to avoid air bubbles.

Withdraw from the water, place a pad of blotting paper over the print, and squeegee it into contact with the glass.

A perfect matt surface can be obtained in this way. More detail is shown than if ready-made matt surface paper is used, and the result is very artistic.

SOME one in Germany, according to a recent account, proposes to build a house of which the framework is to be made up of water tubing, through which warm water is to be circulated in winter and cold water in summer, warming or cooling the inclosed spaces as may be prompted by the requirements. All the floors and ceilings and walls are to be crossed and recrossed with water pipes, affording heating and cooling surface exactly where theory tells us it should be to give the most desirable results. The building of that house would certainly afford an excellent, modern, practical demonstration of the value of these ideal principles.

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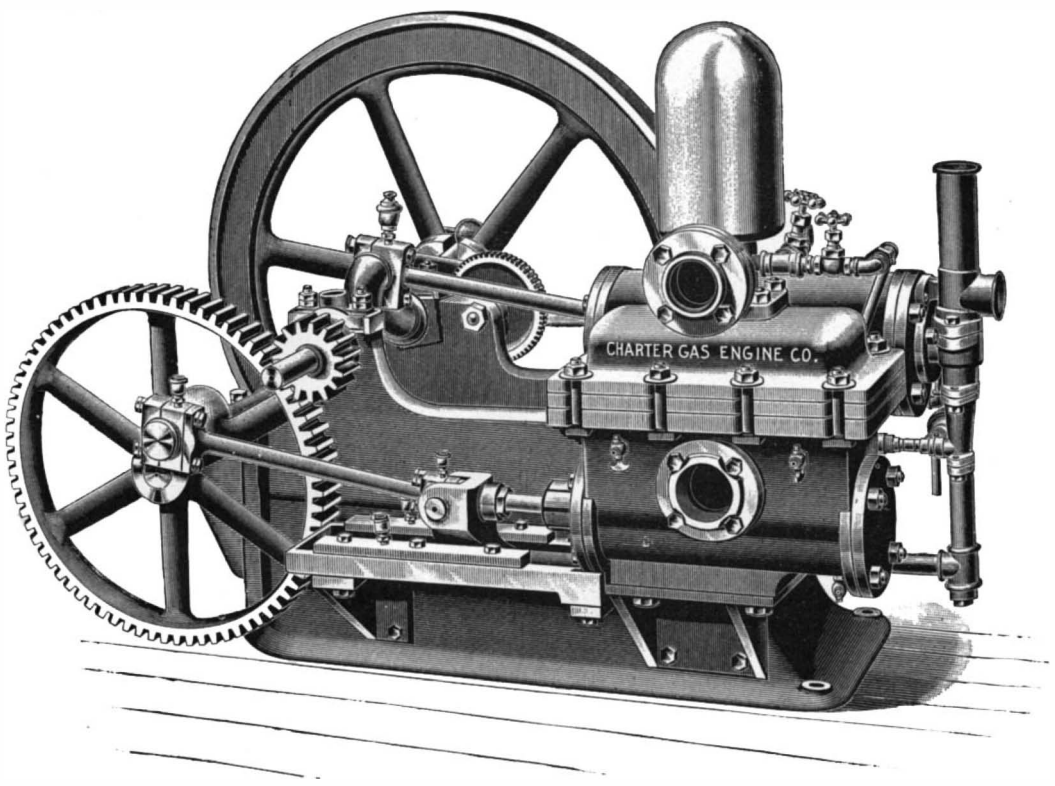
GASOLINE PUMPING ENGINE.

We give an engraving of the Charter gasoline engine and pump combined. This combination was designed for any kind of service that piston pumps are capable of. It is compactly built, a feature which, in places where floor space is valuable, is especially desirable. It is easily operated. When through pumping, nothing remains to do but shut off the gasoline. As no special attendant is required, it is especially desirable for filling railroad tanks, as the station agent or his assistant can take care of the engine and see that the pumping is done without interfering with their regular duties, thus saving the expense of employing a man to go from station to station to fill the tanks. The workmanship and material are the best obtainable. The gears are all machine cut, the pump cylinder is brass lined, and everything about the engine and pump is built on the interchangeable plan. The cut illustrates an engine and pump capable of delivering 60 gallons of water per minute against 100 or 200 feet head, or equivalent pressure. It is self-contained and may be set in operation almost anywhere. This engine is made by the Charter Gas Engine Company, Sterling, Illinois.



COMBINED GASOLINE ENGINE AND PUMP.

The Endurance of Rotating Shafts.

Some of the results arrived at by recent tests made at the Watertown Arsenal are regarded as of special importance in relation to the endurance of rotating shafts. While it has been found that great improvements in tensile strength and elastic limit have been obtained, it has not been shown whether the limit of endurance under repeated strains has been increased. In the rotating tests of cylindrical shafts, alternate tensile and compressive strains are successively applied, and under these conditions of loading no steel has yet been experimented with which will endure a continuous fiber stress of 40,000 pounds per square inch without rupturing, and this result has been reached after a total number of repetitions of from four to seven millions for steels of high elastic limit and tensile strength.

APPARATUS FOR MEASURING THE INTENSITY OF THE PERFUME OF FLOWERS.

Mr. Eugene Mesnard, one of our most clever botanists, has for several years past been making profound researches upon the perfumes emitted by flowers, and which are interesting not only from the standpoint of plant biology, but also from that of the perfumer's art. In fact, the art that consists in extracting the aroma of odoriferous bodies, and in making mixtures thereof agreeable to the smell, is a matter of no ordinary empiricism. It is only through daily practice and multiple comparisons that perfumers have succeeded in establishing the rules that define the combinations of odors that are to enter into bouquets or different toilet articles. On another hand, as regards the production of perfume by flowers, one might seek in vain for the smallest work upon the question.

The idea of an attentive study of the phenomenon, from a biological and industrial standpoint, must necessarily have presented itself to the mind of a botanist. Let us congratulate Mr. Mesnard for having taken it up, and especially for having pursued it with success. Such a study, in fact, was not one of the easiest of matters. The perfume of flowers is something so subtile, so impalpable and so difficult of comparison, that we ask ourselves how it is rendered manageable. The important point to be established in the first place is its intensity, that is to say, the greater or less action that it exerts upon the olfactory organ. The measurement of this is a very delicate matter.

The indirect method that Mr. Mesnard employed for measuring such intensity is very precise. As he remarks, although the sense of smell is not capable, as might be supposed, à priori, of estimating the intensity of an odor in absolute measure, it may be a wonderful comparer. The perfumer who has five or six hundred varieties of odors in his store is perfectly able to distinguish one from another, while it is not in his power to define their intensity with certainty. So, too, it is possible, by the sense of smell, to recognize the existence of a great number of chemical substances, but without it being possible in any way to prejudge of the quantity of such substances that are found distributed through the air. Let us suppose, then, says Mr. Mesnard, that we cause air charged with a certain perfume and air that has passed over a special volatile oil (oil of turpentine, for example) to enter a given receptacle, In this way we may obtain a mixture in which the sense of smell will detect only a neutral odor, that is to say, an odor such that it will suffice to slightly vary the proportion of the volatile oils in one direction or the other in order to detect either the perfume or the oil of turpentine. It may then be admitted that the odors are equivalent, and if we have at our disposal a method that permits of measuring the intensity of the turpentine, we shall obtain by that very fact the intensity of the perfume.

In order to estimate the intensity of the turpentine, there is taken as a basis the property that the latter possesses of extinguishing the phosphorescence of phosphorus. To this effect, there is used a little starch soaked in some sulphide of carbon in which phosphorus has been dissolved. The sulphide evaporates, and the starch, which is a very homogeneous substance, becomes impregnated with phosphorus, which becomes luminous in the air. Mr. Mesnard has shown that in order to prevent the phosphorus from glowing in a given space it is necessary to introduce therein a volume of air that is so much the greater in proportion as it is charged with a lesser weight of vapor of turpentine oil.

Oil of turpentine thus becomes a common standard for the various volatile oils, and the intensity of the perfume emitted by a given weight of volatile oil may be called the ratio between the weight of the oil of turpentine that neutralizes the perfume and the weight of this same oil which, employed alone under the same conditions, acts upon phosphorescence with the same energy.

In all experiments it is necessary to carry along the odors (which are generally heavy) mechanically by a strong current of air.

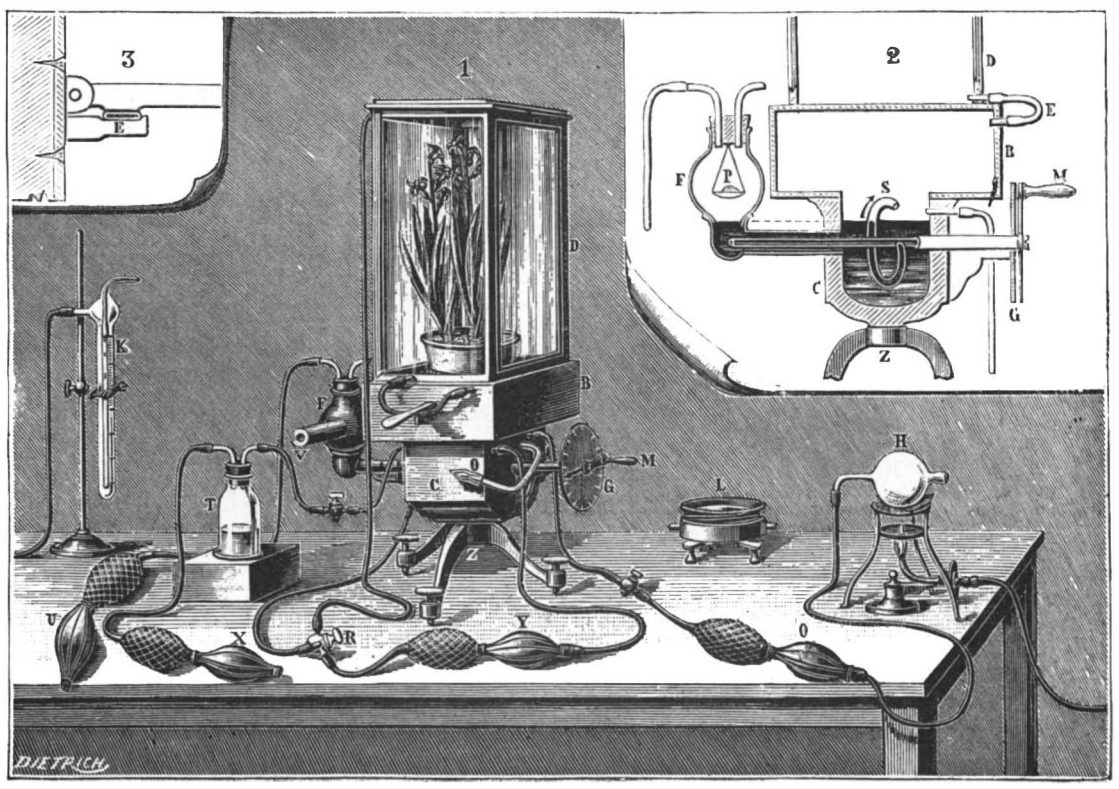
The following is the way in which Mr. Mesnard realizes all these conditions in an apparatus constructed at the laboratory of Mr. Gaston Bonnier.

The flowers, the intensity of the perfume of which is to be determined, are inclosed in a large glass case (No. 1 of the figure) placed upon a pedestal which is itself supported by a metallic tripod, Z, provided with leveling screws. This pedestal consists of two parts: (1) a narrow one, C, hollow in the interior, into which mercury is put, and (2) a wide one, B, which is separated from the glass case by a partition. These two parts form but one and the same receptacle. A rubber tube that may be closed by a lever (E, No. 3) establishes a communication between the case, D, and the mercury reservoir (No. 2). In this same receptacle likewise debouch different conduits, one of which is designed to lead the air charged with oil of turpentine coming from the bottle, T. The odors are detected in the apparatus through the tube, O.

Through the manipulation of a rubber bulb provided in front and behind with ajutages and with a three-way cock, R, it is possible at will to agitate the air either in the case, D, and the mercury reservoir communicating with it, or in each of these two parts isolatedly.

The neutral odor having been obtained as previously stated, it is a question of measuring the charge of the oil of turpentine that has produced this result. The phosphorescent substance is suspended in a blackened glass bulb, F, of about 100 c. cm. capacity that communicates, at its base, with the reservoir through a horizontal tube full of mercury. A black cardboard tube, V, permits the phosphorescence to be observed, even in the full light. For the transfer of the perfumed air from the mercury reservoir to the bulb, F, the following arrangement is employed. In the same axis of the connecting tube is placed a smaller tube, one of the extremities of which opens in the mercury just beneath the bulb. The other extremity of this tube is prolonged by a solid axis provided with a winch, M. Toward the center of the reservoir, it receives a spirally curved branch, S. In a certain initial position, the spiral and the tube that prolongs it may be entirely filled with mercury; but, if the winch be revolved, the extremity of the spiral will enter the atmosphere, and, at every revolution, withdraw therefrom a certain quantity of perfumed air, which it will carry along through the mercury to the extremity of the tube, where the air will escape, bubble by bubble, and become diffused through the bulb.

The winch is revolved until an extinction of the phosphorescence is obtained. The number of revolutions or fractions thereof is proportional to the quantity of air that has been carried along. Moreover, the spiral is graduated, and, by raising the level of the mercury in the reservoir more or less, it is possible to modify the volume. A rubber bulb, U, permits of blowing a little air upon the phosphorescent substance. Another



APPARATUS FOR MEASURING THE INTENSITY OF PERFUMES.

No. 1. D. Glass case containing the perfumes. Z. Tripod. C. Mercury reservoir. No. 2. Internal section of the pedestal that supports the case, D. No. 3. Lever for closing the tube, E, by pressure.

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bulb, Q, distributes warm air throughout the apparatus.—La Nature.

Rules of the Providence Horseless Carriage Race.

The following are the rules and conditions of the horseless carriage race and exhibition which will be held on September 7, 8, 9, 10, 11, 1896, at Narragansett Park, under the auspices of the Rhode Island State Fair Association. The race will be twenty-five miles, for a $5,000 dividend. The rules are very sensible, and the race will tend to awaken public interest in the horseless carriage. It will be noted that an entrance fee of $100 is charged. This is a step in the right direction and will certainly prevent the pitiable defections from the ranks of competing vehicles which have marked both of the former races.

OFFICIAL RULES AND CONDITIONS.

Entrance fee, $100 per carriage, payable August 10. No conditional entries accepted.

The race to be five heats, of five miles each day of the fair, September 7, 8, 9, 10, 11, 1896.

Ten carriages to enter and five to start, or no race.

Vehicles must be able to show a rate of speed equal to 15 miles an hour to compete in the race.

Vehicles must carry one person in addition to the driver. (Weight carried must be 165 pounds.)

Only vehicles propelled by other than animal power allowed to compete.

Vehicles not limited in number, but no one owner can enter more than one carriage and start in the race. If the starters number ten or more, for reasons of safety the carriages may be divided into classes and started in two or more divisions.

Division of the race purse will be in the following proportion to the winners of the race: 50, 25, 15, and 10 per cent of $3,000. First, $1,500; second, $750; third, $450; fourth, $300.

To the vehicle winning the greatest number out of five heats, first money, etc., but all vehicles must stay in throughout the five heats.

Distance waived, but those vehicles which do not cover the course with an average speed of fifteen miles an hour will be disqualified.

Each vehicle will be required to carry its number in large figures; other printed matter not permitted.

Contestants will be required to conform to such rules and regulations as may be made by the association, particularly in regard to their position on the track. All legal responsibility is thrown upon the contestants, the association declining to assume any whatsoever.

In case that less than five carriages shall respond to the call of the starting judge, the race shall be declared off, and to those answering the call and who are ready with their vehicles, their entrance fees paid in shall be refunded. With ten or more entries received, the association will open, in addition to the speed contest, prizes to be competed for as an exhibition, judging to be made on points of manageability, etc., for $2,000, divided as follows:

First prize, $1,000 and the association's gold medal and diploma.

Second prize, $500 and the association's silver medal and diploma.

Third prize, $300 and the association's bronze medal and diploma.

Fourth prize, $200 and the association's diploma.

In the exhibitive competition the following percentage scale of points shall be made the basis of awards:

Speed	40 per cent.	Cost	10 per cent.
Control	20 "	Maintenance	5 "
Simplicity	10 "	Appearance	10 "

Vehicles may compete, if desired, in both racing and exhibition.

Entries will close August 10, 1896. Entry blanks will be furnished on application to Rhode Island State Fair Association, Providence, R. I.

Novel Method of Rapid Photographic Printing.

Some time ago we described and illustrated the method of automatic photographic printing as carried on in this city by the Automatic Photographic Printing Company, who print from glass negatives. Now appears another kind of apparatus, recently patented in England by Mr. Friese Green, for accomplishing the same object in a different way when using flexible negatives. He describes it in his specification as follows:

"I print successively by means of photography a number of impressions from the same photographic or other negative, or from the same series of negatives, upon a continuous band of sensitized paper or other sensitized material, as this is caused to travel continuously in contact with a translucent cylinder which bears or carries the negative or negatives, the said cylinder being lighted internally, preferably by one or more incandescing electric lamps.

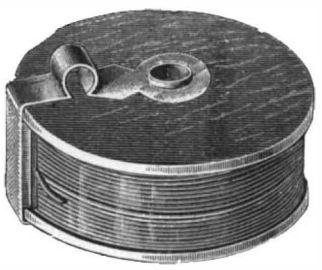
"In carrying out the invention, when the negative or negatives employed are photographic negatives, I use negatives which have been taken upon a flexible translucent material such as a thin sheet of celluloid, and I place this sheet upon a supporting cylinder of glass in such manner that the sheet bearing the negative or series of negatives surrounds the cylinder. Within this cylinder I place one or more lamps. Over or under the cylinder, and in contact with the celluloid sheet thereon, I carry a band of sensitized material from a roll or otherwise, this band being so guided that there is always a part, say several inches, of its length in contact with the celluloid sheet, and this part of the band being maintained taut. Rotary motion is given to the cylinder and forward motion at the same surface speed to the band, with the result that every section of the band equal to the circumference of the cylinder has printed upon it by means of the light a positive impression from the negative or negatives on the cylinder, the same picture or pictures being produced upon every successive section of the band. On leaving the cylinder the band is carried to and through fixing and developing baths; or, if it be required to print upon both sides of the band, it goes from the first cylinder to a second and similar cylinder, where it is printed in like manner upon its second side; it then passes on to the fixing and developing baths.

"When the negatives employed are not photographic negatives, they may, for example, be transparencies or sheets having the parts that do not constitute the design in black, red, or other nonactinic color, and the other parts, that is to say, the design, transparent, or vice versa.

"It is not essential to employ the glass cylinder described if the sheet that bears the negative or negatives is strong enough to be self-supporting."

HARTMANN'S SPOOL WIRE CLAMP.

To confine reeled wire upon its reel, whether it be unannealed or spring wire, holding the wire always in proper position without the necessity of fastening its free ends, the simple and inexpensive device represented in the accompanying illustration has been patented by Charles R. Hartmann, of No. 110 Cambridge Avenue, Jersey City, N. J. It consists of a U-shaped clamp whose side members are preferably connected with the reel by a central tube or pin, permitting the clamp to be readily moved along the outer surface of the reel to any point desired. The side members are provided with loops which serve as handles, and also as springs, holding down the portion of the clamp which extends over the outer surface of the reel, and this portion has downwardly extending flanges inclosing a pad of cork, rubber, leather, or other elastic material. The improvement is especially adapted for holding in place wire designed for use in stringed instruments, preventing the wire from springing off, and, at the same time, permitting any length of string to be readily drawn off, the wire remaining on the reel being held in the order in which it was originally wound.



A Railway Accident Caused by Heat.

Lieut. Col. H. A. Yorke, R.E., has reported to the Board of Trade on the accident that occurred on May 6, near Banavie junction, on the West Highland (North British) Railway. As the 7:35 A. M. passenger train from Glasgow to Fort William was running round the curve between Spean bridge and Banavie junction on that day the whole train, with the exception of the engine, left the rails and ran along the ballast for 115 yards before it came to rest. The permanent way had three rails bent, and 120 sleepers and 112 chairs, more or less, were destroyed.

Lieut. Col. Yorke says he has no hesitation in attributing this accident, which by rare good fortune was unattended by any personal injuries, to the expansion and consequent distortion of the line produced by the great heat prevalent on the day of the occurrence. During the forenoon of May 6 the temperature registered at Fort William, by a thermometer placed in the sun 2 feet above the grass, was 128 degrees. The accident happened at 12:38 P. M., when, the railway at the spot being entirely devoid of shade, the rails were exposed to the full glare of the sun. Driver Thornton says that when he was passing the 97¼ mile post he saw that the line a short distance in front of him was distorted to the left to such an extent that he anticipated that the train would leave the rails. He promptly applied the Westinghouse brake, and almost immediately after this the tender and vehicles composing the train left the rails toward the inside of the curve. Inspector Campbell had traveled over the line early that morning in the van of a ballast train, and noticed nothing wrong with it.

The fact that the engine did not leave the rails, although the train did, may probably be attributed to the flexibility imparted to the engine by the leading bogie, which was able to adjust itself to the irregular curvature of the line produced by the expansion of the rails; whereas the tender, with its six wheels and rigid wheelbase, was most probably the first vehicle to leave the metals, and dragged the rest of the train after it. The mishap must be regarded as purely accidental, and there is no evidence to prove that any blame attaches to any servant of the company in connection with it. There are, however, the report adds, some indications that this portion of the line has not been maintained in a thoroughly first class condition.—London Times.

Science Notes.

Dr. J. Doerfler, of Vienna, has published his Botaniker Adressbuch, a guide to botanists throughout the world. It contains upward of 6,000 addresses of botanists, as well as those of botanical gardens, botanical institutes, societies, and journals.

Jenner's silver lancet case and lancets, the former engraved with the initials and the latter with the name of the discoverer of vaccination, have been presented to the Royal College of Surgeons by a doctor who obtained them from the grandson of Jenner's assistant.

Natural Science notes that Mr. G. A. Boulenger is one of the first to use X rays for purposes of systematic zoology, having used a skiagram to determine the more important points in the skeleton of the rare toad Pelodytes caucasicus, the second known species of the genus represented by a single specimen. The skiagram showed the junction of the astragalus and calcaneum, the form and extent of the frontoparietal fontanelle, the shape of the widely expanded sacral transverse processes and the direction of those of the lumbars.

Prof. H. L. Bolley, in a paper on cleanliness in handling milk, says bacteriological considerations tell us that gelatine plate 3½ inches exposed to air one minute contained the following number of germs. Ordinary living room five minutes after sweeping, 543 germs, eight species. (Fargo.) In open meadow, when quiet, 6 germs, two species. (Madison, Wis.) Open meadow October, quiet, 8, three species. College cow stable between the cows after feeding time, October, 570, eleven species. (Madison, Wis.) University creamery and cheese factory, pasteurization room after scrubbing, August 21, 5 germs, three species. (Madison.) Refrigerator, storeroom temperature 40° F., one species. (Madison, Wis.) (Bull. 21, N. Dakota Agr. Exp. Sta.)

The Lancet states that a surgeon in the United States navy reports that in Japan among 1,200 soldiers 1·58 per cent were red blind and 0·833 per cent green blind. Among 373 boys 1 per cent were red blind, and among 270 girls 0·4 per cent. Among 596 men in Kyoto 5·45 showed defective color sense. Dr. Fielde, of Swatow, China, examined 1,200 Chinese of both sexes, using Thompson's wool tests. Among the 600 men were 19 who were color blind, and among 600 women only 1. The percentage of color blindness among Chinamen is then about 3 per cent, and does not vary greatly from that in Europeans. Dr. Fielde, however, found that fully half of those tested mixed up blue and green, and this investigator thinks that many of the race are quite blind to the violet colors.

Signor Palmieri, who for some years has been studying the earth currents at the observatory on Mount Vesuvius, has discovered that the direction of the current changes when the volcano is unusually active. The earth line runs from a deep well in the village of Resina, at the foot of the mountain, to the observatory, near the top. From 1889, when the experiments began, till August, 1893, the currents were from the lower station to the higher, so that Prof. Palmieri had concluded that the earth currents always ascend. In that month, however, the direction began to change and settled into the opposite of the direction since 1889, the volcano being abnormally agitated. In January and February, 1894, the mountain became quiescent, when the current again moved upward, and later turned downward once more, on an increase in the activity of Vesuvius.

As the result of his prolonged study of those striking phenomena, the thunder storms of Madras, Prof. Smith informs the Scottish Meteorological Society that the first remarkable fact observed by him was that of certain seasons of the year, when sheet lightning appeared almost every night, always in a west or southwesterly direction, and invariably near the horizon; it may be, therefore, he remarks, that these discharges occur in the region where the moist and dustless sea winds meet the dry and dusty land wind, one being, perhaps, positively electrified and the other negatively. In these lightning displays as many as 300 flashes per minute have been counted, this rate being kept up for an hour or an hour and a half. Another notable peculiarity marked of this region is that the heaviest rains are unaccompanied by thunder, while the displays of lightning are not accompanied by any rain.

W. N. Hartley has determined the composition of a coin by an ingenious adaptation of the methods of spectrographic analysis. The spectrum of the coin was photographed and the metals present first ascertained, after which their relative proportions were arrived at by comparing the photograph with a series of quantitative spectra, in which solutions of known strengths yielded spectra with a certain number of lines of definite length and strength. Alloys were then made to imitate the metal, and photographs of their spectra taken in the same way. The third trial produced an alloy, the spark spectrum of which yielded a photograph identical with that of the coin, a "white" sou of the French revolution of 1798, the composition being found by the usual methods of analysis to be: Lead, 13·93 per cent; copper, 72·35; iron, 0·85; zinc, 12·70. By this novel method of analysis the composition of antique jewelry and coins may easily be determined without injuring them in any degree.

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Correspondence.

The Fluoroscope.

To the Editor of the SCIENTIFIC AMERICAN:

While experimenting with a half dozen lot of Geissler tubes recently, I found two of them to give the Roentgen effect sufficiently to light up my fluoroscope very well.

The length of the tube permits one to reach a definite conclusion regarding the terminal, which is important in X ray work. While the question has been definitely settled, yet it may interest some of your readers to apply this simple test. Turn the screen toward the anode so no light can reach it from the cathode, and nothing is observed, then turn screen toward the cathode, and at once light is seen to come from that source. J. T. COLEMAN.

Charleston, S. C., July 16, 1896.

Barisal Guns.

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of June 27 you speak of the Barisal guns, and ask if any one knows of a like occurrence. On the evening of December 28, 1885, I was with a companion in a sail boat on the Gulf of Mexico, about twenty miles southeast of Cedar Keys, Florida. We were becalmed. The next morning the sky was cloudless. There was a light fog and no breeze, the atmosphere was bracing, but not frosty. We were about ten miles out, but in shallow water. Shortly after sunrise were heard reports as of a gun or distant cannon. They came at intervals of about five minutes. We were not certain as to the direction. My companion, who lived several miles further down the coast, said he had often heard those reports on still mornings.

New Castle, Ky. W. S. COOPER.

Effect of a Volcanic Eruption.

The bombardment in some places must have been terrible. I have seen tracts of land, once smooth and fertile plantations, now covered with the great rugged stones so that you have to pick your way among them as you pass. Many of them are four or five feet broad. Of course, these are only the larger stones; the little ones were buried under the soil long ago.

Stones seem to have fallen all through the eruption, sometimes in one place, sometimes in another. Not long after the first expulsion of smoke, a negro boy was tending goats on a hillside. I have seen the place often. Suddenly a small stone fell near him, and then another. He thought that some of his playmates were pelting him from the bushes, and so began to throw stones in return. But the contest was too unequal, for it was the mountain that was throwing stones at him; and ere long he fled in terror, leaving his goats to their fate.

I have no space to tell you the whole story of this great eruption; how many plantations were ruined by the shower of stones, and, far worse, how fifty or perhaps a hundred people were killed by them, with great numbers of cattle and horses; how the lava dammed back a stream and formed a boiling lake, which broke through after a month and came hissing down the valley, overwhelming a whole negro settlement; how ashes were carried five or six hundred miles out to sea and Barbados, eighty miles off, was darkened by the cloud, so that people had to grope their way at noon and use candles in their houses; how the explosions were heard hundreds of miles away, and it was thought that they were the guns of a great fleet or army.

But one thing I must tell you. When the eruption was over and people could ascend the mountain again, they found the crater—the one Dr. Bell had visited—all changed. Instead of the smoking cone, there was a lake of water nine hundred feet below, filling the whole area, and so deep that no one has ever been able to fathom it. And besides this, separated from it only by a thin wall, they found a new crater, even larger; it was nearly a mile long, three-quarters of a mile wide, and eight hundred feet deep, with sides like walls. That pit was blown out by the great explosion.

I have stood between the two craters, and looked down into them. The new one is green and pretty now, with bushes and ferns, and no signs of fire; but the old one is a hideous depth of gray green water, through which bubbles are always ascending and bursting into sulphur fumes at the top. Sometimes the wind carries these fumes over the neighboring plantations, for miles around, as if to warn people that the old fires are not yet extinct. I hope it may be long before they break out again!—Herbert H. Smith, in St. Nicholas.

A CURIOUS phenomenon, first discovered by M. Charles Margot, was shown in a modified form recently by Prof. Roberts-Austen. An electric current was sent through an aluminum wire, raising it to a temperature of 400° above its melting point. Strange to say, it did not fall, the film of the oxide on its surface holding it intact. In this condition it was attracted, owing to the current within it, by a magnet, and by careful manipulation could be made to tie itself into a knot.

Interesting Statistics of Altitude.

In the Niagara rapids the water descends 52 feet in less than a mile; the falls are 164 feet high on the American side and 150 on the Canadian. Mount Lebanon, from whose sides were cut the cedars for Solomon's Temple, is believed to be the highest elevation in Syria, 11,000 feet. Lake Titicaca, in Bolivia and Peru, is 12,000 feet above sea level. It is the highest lake in the world, being 100 miles long by 35 in width. Mount Etna, the largest volcano in Europe, and one of the largest in the world, is 10,050 feet high and 90 miles in circumference at its base. In 1843 Mauna Loa poured out 17,000,000,000 cubic feet of lava; in 1855, 38,000,000,000 feet. In 1859 the lava stream from this volcano ran 50 miles in eight days. The Peak of Teneriffe, 12,236 feet high, is the greatest altitude in the Canary Islands. It is said to be visible at sea, in clear weather, for nearly a hundred miles.

The River Jordan makes the greatest descent in the shortest distance of any stream. During its course of 120 miles it has twenty-seven falls and descends 3,000 feet. It is said by some geographers that Mount Wrangel, 140 miles west of Mount St. Elias, is over 20,000 feet in height, but no authentic measurements have been taken. Mont Blanc is 15,776 feet high. This famous mountain is exceeded in height by many, but its position in the line of tourists' travel has given it a name above many others. Chimborazo, in Ecuador, 21,444 feet, is said to be the highest in that State. Cotopaxi, 19,408 feet, and Antisana, 19,150 feet, are second and third in the order of their height. Mount Ararat, 12,700 feet, is the highest land in Armenia. The perpetual snows that lie upon its summits are believed by the dwellers in the valleys beneath to cover the remains of Noah's Ark. Kilauea, a part of a cluster of volcanic mountains denominated Mauna Loa, is only 3,970 feet high, but is the largest active volcano in the world. Its crater is a great pit 8 miles in circumference and 1,000 feet deep.

Pike's Peak, where gold was first discovered on this side of the Rocky Mountains, is 14,320 feet high. The "Roof of the World," the plateau in the Pamirs of Thibet, is from 10,000 to 15,000 feet above sea level. Mauna Loa, in the Hawaiian Islands, is 13,760 feet high; Mauna Kea, 13,963 feet; Mauna Hualalai, 7,822 feet. Mount Sinai, the mountain from which the law of Moses is said to have been delivered, is 8,000 feet high. California has forty mountains, each of which exceeds 10,000 feet, and quite a number are more than 12,000. The Simplon, under the shadow of which lay the once famous stage route from France to Italy, is 11,542 feet high. There are 412 mountain peaks in the United States, or its Territories, each having a height greater than 10,000 feet. Mount Miltsin, 12,000 feet, is the greatest elevation in Morocco. Although almost under the equator, its summit is never free from snow.

The Illimian Mountain, a peak 21,780 feet, is the highest point of land in Bolivia. There are extensive districts in Sahara which are below the level of the ocean. White Top, 5,530 feet, is said to be the greatest recorded altitude in Virginia. High peaks are numerous in Colorado; there are in that State of mountains 178 peaks, each of which towers above the sea to a height greater than 10,000 feet. The steeple of the famous Cathedral of Strasburg rises to a height of 474 feet.

There are ten mountain peaks in Arizona, each of which exceeds 10,000 feet in height. Clingman's Mountain, 6,707 feet high, takes precedence of all others in North Carolina. There is no mountain 10,000 feet high on the American continent east of the Rockies. There are two or three lakes in Colorado more than 10,000 feet above the level of the sea. Popocatapetl, 17,775 feet above the sea, is regarded as the highest elevation in Mexico. In New Mexico there are thirty mountain peaks rising above an altitude of 10,000 feet. The peak of St. Gothard, above the pass of the same name, in the Alps, is 9,080 feet high. Mount Olympus, whose summit Homer made the abode of the gods, is 9,754 feet high. The cross on the dome of St. Peter's, in Rome, is 448 feet above the pavement of the portico. The chimney of a noted chemical factory in Glasgow, Scotland, is 454 feet in height. Most of the lower valley of the Po, in Italy, is from 5 to 40 feet below the level of the stream. The pyramid of Cheops is 543 feet, but about 30 feet of the former top was ages ago removed. Mount Marcy, in New York, 5,403 feet above sea level, is said to be the highest in that State. Mount Parnassus, the home of the Muses, is only 3,950 feet high. The tower of the Parliament house, in London, is 340 feet high. Stromboli, the island volcano, off the Italian coast, is 3,850 feet high. The most extreme altitude in Alaska is Mount St. Elias, 19,500 feet. Bentonville is the highest point in Arkansas, 1,790 feet above the sea. Long's Peak, the celebrated landmark in California, is 13,400 feet high. Wyoming has forty-four mountain peaks, each of more than 10,000 feet. Mount Shasta, the celebrated volcano of California, is 14,450 feet high.

The cross on the Duomo, in Florence, is 380 feet above the foundation. Mount Pindus, the seat of Greek history and romance, is 7,677 feet high. The dome of the Capitol, in Washington, is 300 feet above the pavement. Mount Rosa, in the Sardinian Alps, is the highest in that region, 15,550 feet. High Knob, 1,799 feet above sea level, is the highest point in New Jersey. Mount Washington, 6,288 feet high, is the highest peak in New Hampshire. Lake Victoria Nyanza, in Africa, is over 4,000 feet above the level of the sea. Mount Carmel, where Elijah slew the prophets of Baal, is 2,000 feet high. The summit of Notre Dame Cathedral, at Amiens, in France, is 422 feet high. The highest falls are those of the Yosemite, some of which exceed 3,000 feet.

The Eiffel Tower is 990 feet high. The Rock of Gibraltar is 1,470 feet. The famous tower of Utrecht is 464 feet. Mount Pilatus, in the Alps, is 9,050 feet high. Bunker Hill Monument is 220 feet in height. The Brooklyn Bridge is 278 feet above the river. The porcelain tower at Nankin was 248 feet high. The Sea of Galilee is 653 feet below the Mediterranean. The Washington Monument is 555 feet from base to tip. The Statue of Liberty, in New York harbor, is 305 feet high.—St. Louis Globe-Democrat.

Protecting Electric Apparatus Against Lightning.

The problem of protecting electric apparatus against lightning has not been altogether one of invention; it has been quite as much one of careful and patient observation. Four years ago it was customary to place a single lightning arrester at the point where protection was desired. To-day the same point is protected by distributing line arresters at frequent intervals over the system. This change has resulted partly through the invention of more simple and effective lightning arresters—instruments which can be trusted at a distance from station attendants and which are free from the necessity of occasional inspection; but perhaps more through a more complete understanding of the problem—of the conditions which have to be met.

The most important characteristic of static discharges from electric circuits is that of selection. Discharges do not, as has been commonly supposed, follow the "shortest and easiest path to earth." Where this the case, one arrester carefully installed would be all-sufficient. The discharge being selective, it is very certain that one arrester is not sufficient, and further, if line arresters be connected at frequent intervals, the path which will be selected will more and more likely be one of the arresters rather than the apparatus in proportion as the number of arresters is increased. This statement is sustained in practice by the rapidly growing use of line arresters. Station arresters are perhaps advisable as an extra precaution, but in general dischargers entering the station offer a fair indication that more lightning arresters are needed on the line.

The question naturally arises: "How many lightning arresters should be connected to a given length of circuit?" The writer recommends four to the mile of wire, but this is by no means to be taken as an invariable rule; much depends upon the local conditions, the character of the soil with reference to ground connections and liability of lightning to strike, the grade of insulation to be protected, the voltage of the circuit, which latter governs the safe spark gap length which may be employed, and the surroundings with reference to telegraph and telephone wires. In general, thickly settled districts tend to decrease the number of lightning arresters which may be required.—A. J. Wurts, in Cassier's.

Household Inspection of Plumbing.

The following questions are given by Mr. Reuben S. Bemis, inspector of plumbing of Providence, R. I., in his report for 1895 as likely to call the attention of householders to points in their plumbing which should be carefully regulated:

Have you a plan of the system of pipes in your house?

Is all the plumbing work exposed to view or easily accessible?

Are the fixtures on the different floors placed over each other so as to avoid horizontal soil and waste pipes?

Are all the pipes airtight as shown by a proper test?

Is the continuation of the house drain outside of the house to the sewer or cesspool properly laid?

Does each water closet have a sufficient supply of water discharged with sufficient force when emptied completely to scour the traps and branch waste pipes?

Are all objects excluded from the water closet which are likely to obstruct the pipes?

When a fixture is not in use for some time, are arrangements made to prevent the water seals in the traps from being broken by substituting oil for water?

Are the traps so arranged as to resist siphonage?

Mr. Bemis also calls the attention of householders to the fact that the water in the traps of the plumbing is apt to evaporate when people go away and shut up their houses for the summer, and that this leaves an open entrance from the sewer to the house. The Engineering Record suggests that the drying of the pipes makes it possible for disease germs on their sides to float upward as dust and get into the house and into the systems of the occupants when they return in the fall, and Mr. Bemis suggests that the outbreak of typhoid fever so often following the return of people to their homes in the fall may be caused by this neglect of the plumbing.

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LORD MAYOR'S COACH.

The illustration which we give below shows the lord mayor's civic state coach, which was built by Messrs. Offord & Sons, Limited, of 67 George Street, Portman Square, in 1887, and which is more generally known as the "Jubilee" state coach. As will be seen, it is a most handsome turn-out, and has been greatly admired by visitors to the Crystal Palace Exhibition. This carriage was constructed for use in the city ceremonies during the office of Sir Polydore de Keyser, and, as will be noticed from our "cut," it is of exceedingly expensive and elaborate construction. It is hung on C and under springs, with swan-necked double steel perch, giving full lock under for turning in the narrow city streets. The brass and gilt work which is introduced is very massive in appearance, and the decorations embrace both national and civic emblems. Especially noticeable are the rose, shamrock and thistle of the solid roof cresting. The interior is adorned with the most costly golden and blue silk; while the lamps, of solid chased brass, are also noteworthy and exhibit very fine workmanship. We are indebted to the Hub for our illustration.—The Road.

LORD MAYOR'S COACH.

A Curious Accident.

A peculiar accident occurred on July 16 at the new tower of the New York and Westchester Water Company, in Glen Park. A sheet iron worker was on the tower, eighty feet above the ground. He lost his balance and fell down the inside of the tower. As he felt himself going over he threw himself against the side of the tower. All the way down he bounded involuntarily from side to side. As he neared the ground he struck the sides of the tower less frequently and his velocity increased. The zig-zag course saved his life, as he will probably recover.

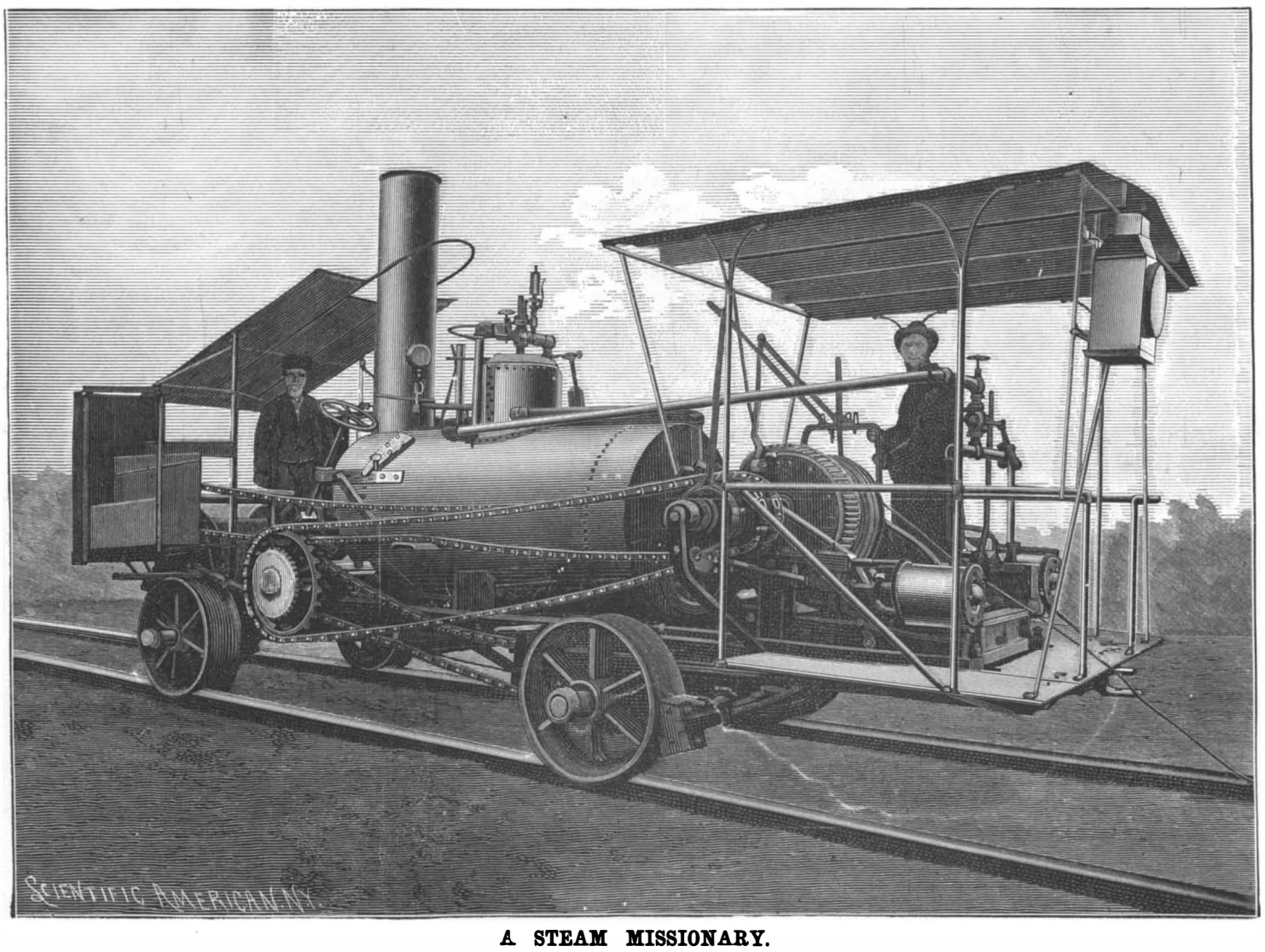
A STEAM MISSIONARY.

We have received from Mr. James H. Stevens, of the Barney & Smith Car Company, Dayton, O., a photograph of a novel and interesting logging machine, which we herewith reproduce. Mr. Stevens has forwarded the design with the request that it should be "brought before the mechanics of the country merely as a suggestion in the direction of cheaper logging in timber too sparsely distributed to justify the use of steel rails," and he trusts that "some one may be stimulated to get up something on the same order that will be a great deal higher, with the same or greater power, and that can be utilized for pioneer work as well as lumbering."

The engine, as will be seen, is adapted to run on a pole road; but it is also arranged so that it can be quickly changed so as to run on a standard iron road; or, if desired, upon the ground as a traction engine. The engines are of 30 horse power, and steam is supplied by a boiler of the Scotch marine type. The weight of the whole engine is about 11 tons, and the cost about $3,000. The train, when equipped for work, will consist of the engine, as shown, a water car, and four logging cars. The engine is provided with sheet-iron wood boxes, one at the front and one on each side; and on the right hand side, as shown in the cut, is a water tank which counterbalances the weight of the heavy chain gearing on the opposite side of the boiler. It is provided with a shaft and pulley through which it could furnish power for a sawmill or for other purposes.

The engine is mounted on springs and the boiler is arranged so that it can be tilted on sharp grades in order to maintain the water level. To enable it to turn very sharp curves without breaking the driving chains it is provided with compensating gear. At each end of the engine a steam reel is provided, each of which can carry 2,000 feet of wire rope, by means of which the engine can haul in logs from a distance of 2,000 feet to right or left. By means of these ropes it can haul itself up a grade of 1,700 feet to the mile; and then use its whole force in hauling the load up after it. This system of wire haulage it is claimed is specially adapted to logging in swampy country, where the ground is too soft to permit the use of cattle. The first machine to be built has been shipped to Nicaragua, where it will be used in getting out mahogany logs in a locality where the ground is wet and spongy. In explanation of the novel name which it bears Mr. Stevens says: "I named it this because the thought occurred to me that if it were placed in the proper hands, a machine like this would become a great civilizer."

We place this invention, which is not patented, before our readers, as possessing features of real merit and utility, and well worth examination. The machine is not built for looks, and is open to that improvement which Mr. Stevens invites; but for work in virgin forest lands, and particularly in getting out those valuable hardwoods which abound in swampy jungles, it certainly should prove to be well adapted.



A STEAM MISSIONARY.

A New Thames Tunnel.

The Bridges Committee of the London County Council have prepared a scheme which will shortly be submitted to the Council for approval, for the construction of a tunnel under the Thames to connect Millwall with Greenwich. It is intended that the tunnel shall be for foot passenger traffic only, having a footway of 8 feet, with a headway of 9 feet 4½ inches in the center, reduced to a minimum of 7 feet 6 inches at the outsides. The cast iron tubing would be lined inside with concrete, faced with glazed tiles, and the tunnel would be lighted by electricity. The shafts on either side of the river would be 32 feet 8 inches internal finished diameter, and a spiral staircase 6 feet wide would be constructed, 20 feet clear diameter being left in the middle, in which hydraulic lifts might be constructed at some future date, should necessity arise. The height of the stairway would be 43 feet 6 inches on the north and 51 feet on the south side of the river. The total estimated cost of the works amounts to £65,000. The land which would be required would cost £5,500, making a total for land and works of £70,500. In addition to that, as the law at present stands, £25,000 would have to be paid as compensation to persons interested in the existing ferry and ferry rights, but the committee hopes the Council will succeed in obtaining a clause by which the improvement of interest will be considered, thereby reducing this amount very considerably. The capital cost of the tunnel, including compensation for the ferry rights—viz., £59,500—has been reduced to an annual sum, and amounts to about £4,190 per annum for the first year, diminishing each year till the debt is paid off in fifty-three years. The committee asks the Council to seek the necessary parliamentary powers to carry out this scheme, which they state will meet a long desired requirement of the people living on both sides of the river.—London Times.

AT a recent meeting of the Royal Society, Prof. Worthington and Mr. R. S. Cole showed instantaneous photographs of splashes taken each with an electric spark giving an exposure of less than three-millionths of a second. The spark could be so timed as to pick out any desired stage of the splash. In this way the progress of a great variety of splashes has been followed in minute detail. Especially interesting are those which illustrate the formation of a bubble.

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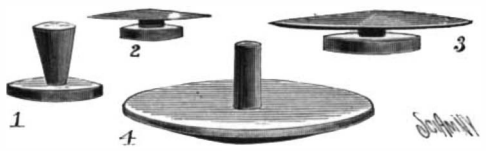
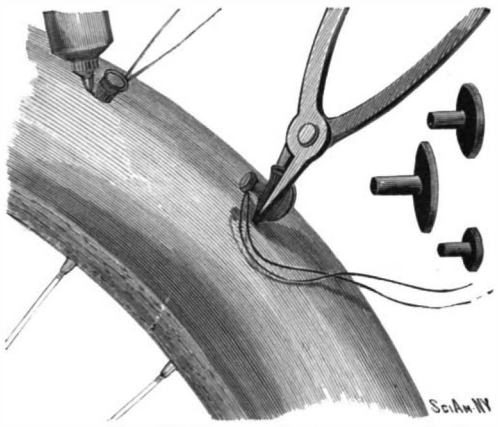
THE REPAIR OF SINGLE TUBE BICYCLE TIRES.

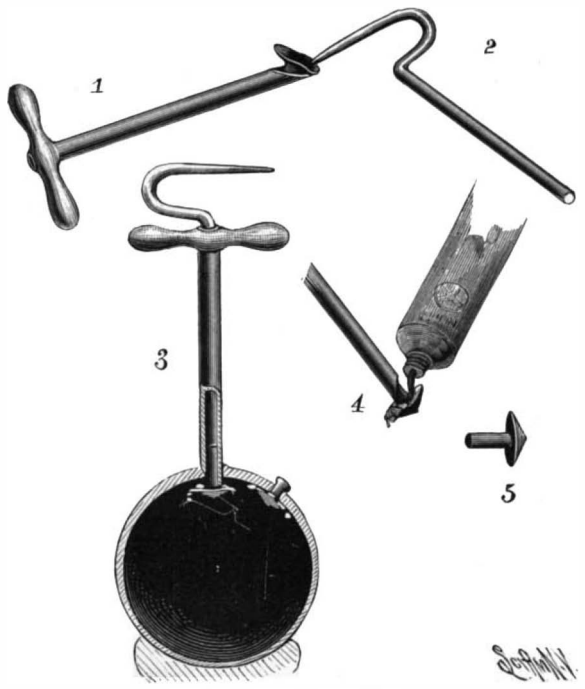
Single tube bicycle tires have become deservedly popular among American riders. Although it is sometimes more difficult to effect in them a positive and permanent repair than in the inner tube tire, a temporary repair, good for a thousand miles or more of riding, may often be made in a few minutes. We illustrate several methods of repairing such tires, which methods are divisible into three classes, plug repairing, patch repairing and band repairing.



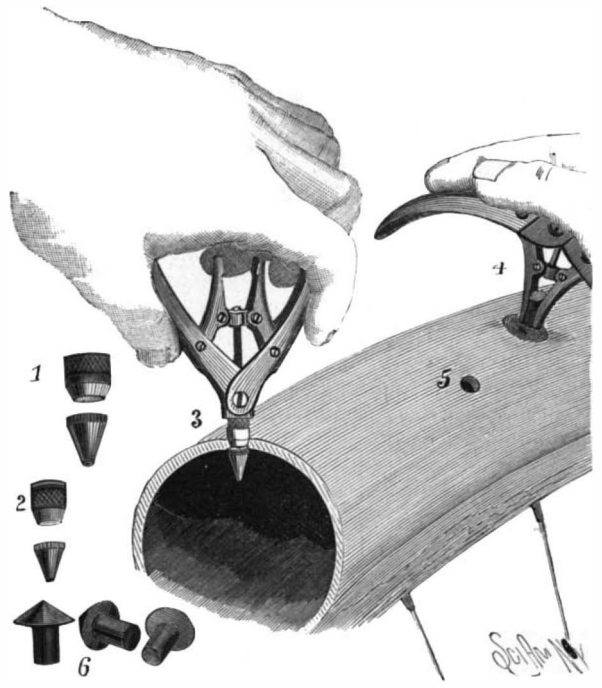
No. 1.



No. 2.—INSERTING PATCH WITH PLIERS.



No. 3.—TIRE PLUGGER.



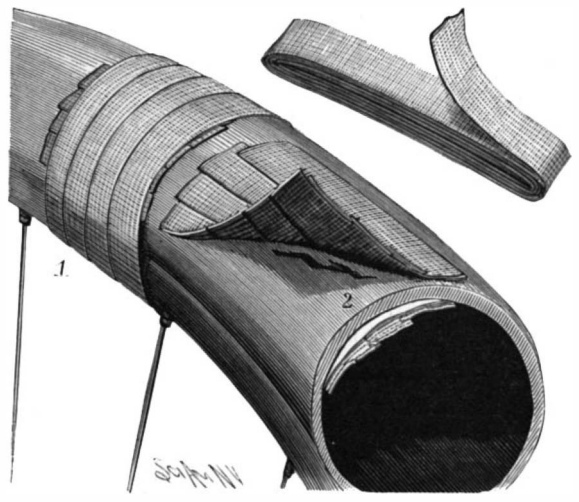
No. 4.

Our first cut illustrates typical forms of plugs, one with a cylindrical stem, two double-headers shaped somewhat like cuff buttons and another with a conical stem. They are made of various sizes and proportions.

One of the simplest and most popular means of inserting a plug is shown in the cut No. 2, where pliers specially made for the purpose are employed. The approved method of operating is to tie a string or strong thread tightly around the stem of the plug, which plug is then grasped by the pliers in the manner shown, is well lubricated with solution and is forced into the aperture with the head innermost; the solution is then squeezed out of the flexible tube, which is supplied with a special nozzle for the purpose, through the puncture, so as to fall upon the head of the plug within the tire. The tube of solution is withdrawn, the plug is drawn into place by the thread and part of the protuberance is cut off. The double header plug, such as shown in Fig. 3 of cut No. 1, is inserted by this instrument with the small head innermost. The large head is cemented to the outside of the tire by covering its inner surface and part of the tire adjacent to the puncture with rubber solution, allowing the surfaces to dry as perfectly as possible out of contact with each other, and by then pressing them together, when they instantly adhere.

Cut No. 3 shows a method of introducing a plug by a very simple apparatus. Fig. 1 is a metal tube with cross handle. The tube is cut off obliquely at its lower end. With it is provided a bent piece of metal, Fig. 2, by means of which a plug previously moistened with a solution as a lubricant only, Fig. 4, is forced into its oblique end, Figs. 1 and 2. The tubular tool is then driven into the puncture and the pricker is forced down through it after its introduction, Fig. 3, so as to expel from it the head of the plug. On withdrawal of the two tools the plug is left in the aperture, and its head may be pulled up by means of its projecting stem against the interior of the tire. Fig. 5 shows the plug, and in the section of the tube one plug is shown in position.

In the next cut, No. 4, a more complicated apparatus is shown, used for introducing the plug shown in Fig. 6 of such cut. A pair of pliers of peculiar construction are arranged to support a cylindrical cutting edge, Figs. 1 and 2, of varying size. For each cutter a conical bed piece is provided, also shown in Figs. 1 and 2. The bed piece is secured to the pliers below its cutter, and the bed piece, which, as held by the pliers when open, will be in advance of the cutting edge, is forced through the puncture. By closing the pliers, the bed piece is drawn up against the cutting edge, so that a small round disk is cut out of the rubber. The cutting operation, as shown in Figs. 3 and 5, shows the result. By reversing the pliers and opening them, the plug is held in the other jaws, as shown in Fig. 4, and after a thorough lubrication with the solution is forced through the aperture into place.

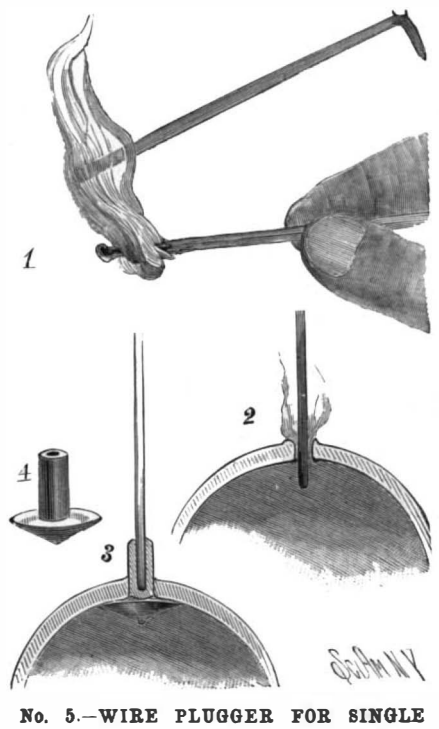


No. 8.—PUNCTURE PATCH MADE OF TAPE.

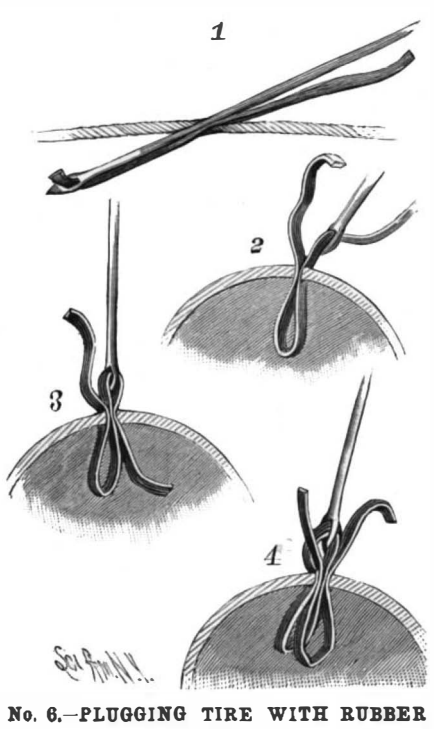
A peculiar system of introducing the plugs is shown in Fig. 5, where a plug with a hole in the stem is used. A piece of wire is heated, Fig. 1, in the flame of a match, and while hot is forced through the puncture, burning off the ends of the threads and leaving it ready for plugging, Fig. 2. The wire, still hot, or slightly reheated if necessary, is now inserted in one of the apertures of the plugs, 4, to which it adheres. The plug, after lubrication, is forced into the puncture by the wire, which is then drawn back, pulling the head of the plug up against the interior of the tube.

We here encounter for the first time the burning out of the hole with hot wire, and for all phases of tire mending where a plug is to be used it is an excellent plan to burn out the hole rather than to cut it out by any means. The burning out removes the projecting ends of the threads and does away with the fertile source of so-called porousness.

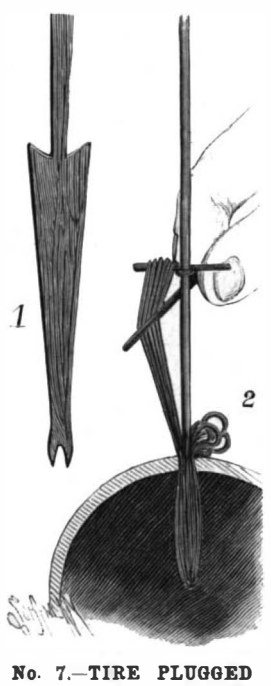
Band plugging is shown in the next cut, No. 6. A needle about eight inches long, with an end not too sharply pointed and containing a large perforation, is used. The other end should be bent into a ring-shaped handle. The needle is threaded with one or more bands of India rubber. It is shown as used with a single band. If it be desired to introduce a single thickness into the puncture, on account of its smallness of size, the manipulation shown in Fig. 1 is adopted. The needle is threaded, a small portion of the band projecting from the eye; after lubrication with solution, the needle is introduced, and being directed very obliquely, is pushed far in, the band being held back on the outside until it snaps out of the eye of the needle. On withdrawing the needle, a single thickness of the band is left in the puncture. If two thicknesses are required, the needle is thrust well into the tire through the puncture and withdrawn, as shown in Fig. 2, carrying with it the end of the band. In executing the manipulation of Fig. 2, the condition shown in Fig. 3 is always reached; when, if the ends are long enough, the bands may be cut at the bend where it passes through the eye of the needle, leaving three thicknesses in the hole. In Fig. 4 the double band is forced well into the hole, and then the band is withdrawn to be cut off close to the eye of the needle, leaving four thicknesses in the hole. By carrying out this system almost any number of thicknesses of bands



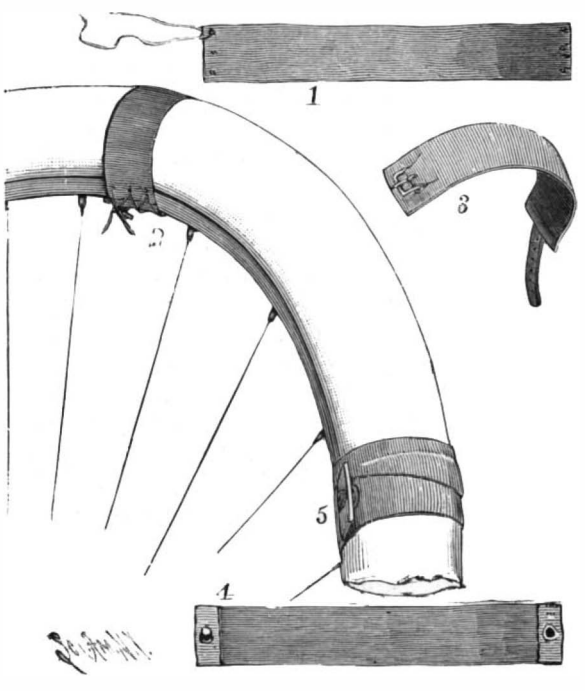
No. 5.—WIRE PLUGGER FOR SINGLE TUBE TIRES.



No. 6.—PLUGGING TIRE WITH RUBBER BANDS.



No. 7.—TIRE PLUGGED WITH RUBBER BAND.



No. 9.—PUNCTURE BANDS.

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may be introduced. The process seems exceedingly well adapted for irregular punctures.

Our next cut, No. 7, shows a tool for introducing small rubber bands in quantities. Fig. 2 shows a needle with a small cross piece and notched end. A quantity of small endless bands are strung upon it, their center portions passing over the notched end and their ends being looped over the two extremities of the cross piece. The needle and cross piece are so proportioned as to stretch the bands considerably. After lubrication they are forced into the tire as shown and the looped ends are pushed off the crossed piece. The needle is then withdrawn, leaving the bands in the hole, to be trimmed off as desired. Fig. 1 of the same cut shows a needle cut out of a piece of hard wood to be used in an emergency in perfecting this kind of a repair.

A patch repair executed with the well-known tire tape is shown in cut No. 8, designed for use especially for bad cases. A patch is built up of tire tape, by cutting short pieces and placing them transversely to each other, batten fashion. If a cut is large enough, such a patch is placed in the interior of the tube and pressed up firmly against the cut by forcing the sides of the tube together. Another such patch is placed outside and the whole is secured by winding the tire tape. Solution may be used to secure the tape in place if the tape is too dry to adhere without it.

Cut No. 9 shows a puncture band, which may be of heavy pure gum rubber or of leather, Figs. 1, 3 and 4. Fig. 1 is arranged to be secured by strings around the tire. Fig. 3 has a buckle and a strap, and Fig. 4 has the well-known eylet and stud catch used on gloves. To apply these, if made of leather, an India rubber patch is first cemented by solution over the puncture on the outside of the tire and over it the band is secured.

The band shown in Fig. 4 is of somewhat thick and elastic India rubber, long enough to be wound twice around the tire before being secured, thus producing a very perfect tension. This or other bands can be directly cemented over the puncture, the rubber patch being dispensed with. This is not recommended. As a substitute for the bands a leather shoestring, which is wound tightly over the rubber patch, is excellent. In all these cases the tire should be incompletely inflated, so that when finally inflated the tension is increased.

There are two points relating to the subject to be considered. One is the alleged porousness of tires. Single tube tires in general consist of an inner lining of India rubber, surrounded by a fabric, the latter bedded in and coated with India rubber. The tightness of such a tire depends almost entirely on the maintenance of the integrity of its inner lining. If this is punctured or injured from the inside, air will get into the fabric and following the threads escape in a quantity of minute streamlets, so that when sponged with water, minute bubbles will be seen escaping from an indefinite number of places. The tire may be punctured by a nail and the puncture may be mended so as to be perfectly tight, yet the nail may have punctured the inner coating on the opposite side too without cutting through, and this puncture may be enough to start leaks, producing so-called porousness. There is no way of finding the location of such an inner lining puncture.

Another point relates to the putting on of a patch by means of rubber solution. The adherence of these patches does not depend on cement-like action of the India rubber, but on cohesion. The best way of doing it is as follows: The surfaces to be fastened together are coated with the solution, which is allowed an hour or more to dry. If possible it is well to give ten to twelve hours. Or, after drying two or three hours, a second, and after a similar interval, a third coating of the rubber may be given to the surfaces, the final drying being as long as possible. When perfectly dry, the surfaces are placed in contact. The instant they touch they cohere and the operation is complete. In mending on the road, where time is an object, the surfaces coated with solution may be dried more rapidly by exposing to the sun and by blowing upon them.

A puncture in a single tube tire may be readily found by immersing the tire in water, and still more simply by wetting the surface with water, using a sponge or even the hand and watching for the escape of the bubbles from the wet surface. It is assumed, of course, that the tire is kept inflated all the time. For burning out a puncture in an emergency a hairpin may be employed, heated by a match.

As a desperate remedy a porous tire may have a longitudinal slit, about six inches long, cut through its inner periphery. At one end a hole half an inch in diameter is made. A weight, such as a nut from a bolt, is tied to a string and it is worked around the tire. An inner tube is drawn by it into the tire. The slit is then laced up, and the tire becomes an inner tube tire. This is not practicable except with tires having a good fabric to hold the lacing.

Percentage of Loss of Current in Electric Railways.

In St. Louis the electric railway officials are very much concerned over the ever-increasing loss of current. The rail return has proved, under present practice, inadequate, with the result of loss of power to the company and the partial destruction of lead and water pipes near the power houses. The ends of each rail are bonded with a small copper wire, and the running of supplementary wires between the rails, so that the current, after passing through the motors, can find an unbroken passage back to the generators at the power house. The bonds and wires used in the past were small, and many of them are now broken, so that the current, seeking the path of least resistance, leaves the wires and rails in hundreds of places, passes through the moist clay, and starts off along a water or gas pipe for some distance; then again wends its way through the moist earth back to the wires and rails. This is called by the electricians leakage of the current, and the action it produces on the pipes is termed electrolysis. Up to the present time but little has been done to remedy the evil. The trouble is becoming so marked that steps must soon be taken to suppress it.

The rail has a large current-carrying capacity and would prove an excellent return conductor were it a continuous one. But no matter how close the ends are to each other or how tightly clasped with fish plates and bolts, the connection for the conveying of current is a poor one. To obviate this, holes are bored near the ends of each rail and a copper wire the thickness of a lead pencil soldered and riveted to the two rails. This is called bonding. Every few feet copper wires were, up to a year or so ago, soldered to these and crossing over to the opposite rail, and also connected to a wire running alongside the track. Later on these wires were found too thin, and on new work thicker copper wires were used. The latest is a copper rod, each end of which is riveted to a rail. Even the copper rod bond, riveted to the web of the rail, has not proved satisfactory. Electric welding was tried on the Baden and St. Louis line, and the rail made a continuous one. The cost is prohibitive, however; the price per joint being about $6, and there are 352 joints in a mile. Cast welding costs $3 to $3.50 per joint.

Three of the St. Louis roads have an almost perfect rail return, namely, the Baden and St. Louis, the Southwestern and Citizens' line. On the first named the rails are electrically welded, and on the other two they are cast welded. The later process has been found by experience to be as good as the electric weld, while its cost is only half as much. A short time ago workmen started cast welding the rails of the Forest Park, Laclede Avenue, and Fourth Street line. Mr. P. C. Maffitt, president of the Missouri Railroad Company, had a great deal of trouble with leakage of current. It was a case of buying additional generators or attending to the return conductors. Mr. Maffitt decided to cast weld the joints, and this is being done without preventing traffic or even hindering it in the least. The joints are prepared during the day, and after midnight the perambulating foundries come along with molten iron, and 100 pounds or more of liquid iron is applied to each joint. This kind of a joint does away with fish plates, bolts, copper bonds, supplementary wires, and the like. When the work is finished the consumption of energy, it is estimated, will be from 15 to 20 per cent less than at present.—St. Louis Globe-Democrat.

Recent Archæological News.

Among the fragments of Egyptian papyri at Dublin, eighty lines or parts of lines of Homer's "Iliad" have been identified out of a manuscript of the third century before Christ. In the eighty lines are thirteen which do not exist in the "Iliad," but Prof. Mahaffy asserts that the Alexandrian critics took great liberties with the text.

Dr. Richardson, of the American School of Archæology, and his party, who have been making excavations in Corinth, have discovered the ruins of a large theater and a key to the topography of the ancient city of Corinth.

Over four hundred diamonds are known to have been recovered from the ruins of Babylon. Many are uncut, but most of them are polished on one or two sides.

A Druidical dolmen has been transported from Brittany and erected again in its original form over the grave of an archæolcgist named Piketty, at Meudon, outside of Paris. It is called the dolmen of Kerhan, comes from the neighborhood of Lochmariaquer, and consists of fourteen blocks of granite.

Santorini, the ancient Thera, the chief island of the Sporodes, in the Ægean Sea, has prehistoric remains which will be systematically explored by the German school of Athens.

Herr Dorpfeld, President of the German Archæological Institute, Athens, has resumed the work of excavation at the southwest of the Acropolis, and has discovered two statuettes of Hecate and Demeter, in brass.

At Delphi, a beautiful bronze statue of Apollo, eight inches high, has been discovered. It is thought that more valuable votive offerings may be found in the same place.

Ruins of an important temple have been discovered at Conea, between Velletri and Porto d'Ansio. It is believed to be the famous shrine of the Mater Matuta spoken of by Livy, and to mark the site of the ancient Satricum. The temple had been added to. The earliest building belongs to the sixth century before Christ. The pediment of the primitive temple was adorned with splendid painted terra cotta statues of the Greek archaic type, the most important yet found in Italy. Traces of two other temples, bits of the walls of the city, and the site of the necropolis have also been found, and further important discoveries are expected.

At Chassenon, in the Department of the Charente, France, a statue of a Gallic god has been found in an old well believed to have been filled up in the time of the invasions of the barbarians. It is two feet high, squatting like a Hindoo Buddha, and has the collar of the Gauls around its neck.

The excavation of the so-called "Temple of Vesta," at Rome, has brought to light the foundations of surrounding walls. These are built in what is called opus reticulatum; there have also been discovered old black glazed Etruscan vases and several lamps, which have names in the Etruscan language scratched on them.

Recent archæological discoveries along the valley of the Tennessee River, in northern Alabama, have led to the belief that the region was once inhabited by cliff dwellers, and an expedition from the University of Pennsylvania is soon to explore the caves in that region. Prof. Mercer will head the expedition, and it is believed that valuable discoveries will be made. Many specimens of ancient pottery believed to have belonged to the cliff dwellers have recently been found in the caves along the Tennessee.

M. Maspero has found that the scarabs and other Egyptian ornaments discovered at Eleusis all belong to the time of the Ptolemies, and, consequently, their discovery does not help the theory that the Eleusinian mysteries originated in Egypt.

Excavations have been begun on the site of the ancient Roman city of Verulamium, near St. Albans, England. It is hoped that traces of the adjacent city of Cassivelaunus, who was defeated by Cæsar, may also be found.

From the discovery of the remaining fragments of the Hymn to Apollo at Delphi, imploring the protection of the Roman government for Delphi and Athens, the date is fixed as being not earlier than the taking of Corinth by Memmius, in the year 146 B. C.

Dr. Robert Fletcher, in his "Anatomy of Art," and Dr. Luigi Sambon having shown conclusively that Greeks and Romans must have had a good acquaintance with surgery, it seems strange that in the mediæval European period there was dense ignorance and no skill in amputation. Sword and lance wounds were necessarily of constant occurrence then, and the treatment was merciless. We have shown before how there was among primitive people a fair acquaintance with surgery, and even a knowledge of the refinements of it, as in plastic operations. The discovery of a manuscript of the eleventh century shows us conclusively that among the Arabs and in Syria at the time of the first crusades there was a fair knowledge of surgery, and that the Syrians held in poor estimation the Frank doctor. Osama tells how a knight was suffering from an abscess of the thigh and a woman from consumption. The Frank physician had the knight's leg put in a block, and it was hacked off with a sword. The woman was treated by having her hair cut and a cross cut into her skull. The knight died at once and so did the woman. Then the chronicler says the Syrian doctor who had been called in left disgusted, having learned "more about Frankish medicine than he had ever known before."

Instinct Not Always Faultless.

Many persons still believe that the instinct of animals preserves them from certain accidents, and that they never eat anything that is injurious to them. Well-instructed persons have long known that in this regard animals are no better off than men. A chicken does not hesitate to drink paint; a cow partakes of water in which bags containing nitrate of soda have been washed; ducks strangle and choke in swallowing snails. M. Giraud, a veterinary at Barnewitz, now notes a fact that merits the attention of poultry farmers. He has observed numerous cases of poisoning in ducks following their feeding on caterpillars, especially those of the cabbage moth; these caterpillars have been given to the fowls in mass or are found on the cabbage leaves furnished them for food. After from six to twenty hours, according to the number of caterpillars eaten, poisoning manifests itself by loss of appetite, great weakness, tottering steps, accompanied sometimes by symptomatic movements, finally by difficulty of breathing and often death, after an agony of variable duration, during which the beak and claws grow pale. The lesions disclosed by an autopsy consist chiefly in an inflammation of the digestive passages. The disease is not always fatal.—Cosmos.

Astronomical.

A dispatch from Geneva, New York, dated July 22, says:

"Prof. William R. Brooks, director of Smith Observatory, while observing the moon last night with the large telescope, made a most interesting and unique discovery. A dark round object was seen to pass rather slowly across the moon in a horizontal direction. Prof. Brooks believes that it was the passage of a dark meteor between the earth and the moon, far beyond the earth's atmosphere, so that it remained non-luminous. The observation is new in astronomical records."

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RECENTLY PATENTED INVENTIONS.

Engineering.

GAS, OIL, OR VAPOR ENGINE.—Frank S. Mead, Montreal, Canada. The giving of an impulse to the piston at every revolution of the crank shaft is the principal feature of a simple and durable engine designed by this inventor. A heated vaporizing and exploding chamber receives the fuel from a pump unmixed with air, this chamber heating and holding the oil, vapor or gas as the piston rises and presses fresh hot air into it, and the mixture being ignited when the piston is on the up center, by an electric spark, a heated pipe, or in some other suitable manner, so that the explosive charge passes into the working end of the cylinder to drive the piston down. The pump is particularly adapted for pumping the liquid oil, or taking the vapor of previously heated oil, or gas, and forcing it into the exploding chamber.

VAPORIZER FOR OIL ENGINES.—Isaac F. Allman, Jersey City, N. J. This vaporizer has a mixing chamber connected by a pipe with the cylinder of the engine, a suction being produced in the chamber on the outward stroke of the piston at the time the charge is to pass into the cylinder. The invention consists principally of a valve box or casing having air inlets, a valve seat into which opens an oil supply channel and a valve covering the orifice, but adapted to open upon suction from the cylinder to draw air in through the openings and through the valve seat, the air on its passage taking up the oil discharged into the seat through the channel. The engine exhaust pipe passes through the mixing chamber to vaporize the oil and mix its vapor with the air.

Railway Appliances.

CAR FENDER.—Rudolph C. Hoyer, Memphis, Tenn. Suspended just in advance of the wheels and beneath the car body, according to this invention, is a lower or receiving fender to receive any object that may be encountered by a moving car, while held above and in advance of this fender is a second fender, which is given a rotary reciprocating movement, causing it to act in the capacity of a rake to convey any object in the path of the car on to the receiving fender. The upper fender is constantly reciprocated from the car axle when the car is in motion, and has a yielding lower edge and elastic covering, so that it will not injure a body with which it comes in contact.

CAR FENDER AND BRAKE. — John Matzinger, Mount Vernon, N. Y. This inventor has designed a fender which will always be in position for contact with a person or object that may be on the track, preventing any one from being run over by the car, while the brakes are applied to immediately stop the car when any one is struck by the fender. The fender consists of a skeleton frame with bed of woven wire and rubber cushion, and is light and strong and readily transferred from one end of the car to the other. The fender is normally held in outward position by springs, but when an object is struck in the path of the car the inward movement of the fender causes a brake shaft to be carried downward, bringing a set of brake shoes beneath the wheels.

BRAKE.—Alexander H. Moyes, Ogden, Utah. This is an improvement in automatic fluid pressure brakes of the Westinghouse type, and provides a quick and positive action of applying and releasing the brakes, and for graduating the tension of the brakes without completely releasing them. The brake cylinder is rigid with and projects at one end into an auxiliary reservoir within which is a second cylinder, while at the opposite end is a third cylinder communicating with the brake cylinder, there being in the side of the latter a double acting valve and cylinder connected with a branch pipe leading from the train pipe connected with the engineer's valve and the main reservoir.

CAR COUPLING.—Louis L. Moore, Calhoun, Ky. This coupling is adapted to automatically couple meeting cars, and permit of their ready uncoupling from either side of the car. Within the drawhead chamber is a rocking dogholding in receiving position a rocking arm, and a coupling block sliding in the drawhead is loosely connected to the arm, the coupling block dropping through the link when the latter pushes thedog rearwardly. This coupling is simple, durable, and inexpensive, and there are no exposed working parts to be obstructed by sleet or snow in the winter season. The improvement may also be used along with the ordinary link and pin car coupling.

SWITCH AND MATE.—David F. Carver, Brooklyn, N. Y. This invention is for an improvement on a formerly patented invention of the same inventor, in which a swing tongue has a certain novel arrangement of flanges of such length and breadth as give the tongue a contact along its whole length with either the guard rail or the running rail of a switch. The improvement provides for a modification by which provision is made for the entrance of a switch iron or equivalent device, mainly to facilitate the removal of dirt from between the opposing side edges of the tongue and rails adjacent to the pivoted end of the tongue.

SPEED INDICATOR.—Talbot O. Bateman, Fort Worth, Texas. This device is specially designed for use on trolley cars or vehicles, indicating automatically to a following car or to any observer whether a car is running at a proper rate of speed or is going too fast. A governor, mounted in a casing is connected with moving part of the vehicle, and in the casing is a lever connected to the governor and an insulated plate having two contact points, past which moves a contact plate actuated by the lever, thus making signals and electrical connections. The governor is controlled by the running part of the car or vehicle, the device actuating a normal signal and an alarm or danger signal.

SCREW JACK.—Alexander H. Moyes, Ogden, Utah. This is an improvement more especially designed for use on railroads, for conveniently jacking up cars, engines, journal boxes, etc. The invention comprises a casing in which screws a post having at its upper end a head with a cap turning on ball bearings, while a sleeve on the casing has a handle and an extension through which slides a bolt adapted to engage the inside of the wheel rim to hold the wheel down on the rail while jacking up the journal boxes. A weighted pawl pivoted on the sleeve is adapted to engage one of the exterior circular threads on the casing, and it is not necessary to use blocks and similar devices, as heretofore.

Electrical.

AMALGAMATOR.—Francis B. Austin, Temple, Arizona. According to this invention currents of electricity are applied to the amalgamating plates to attract and hold fine particles of gold, the apparatus providing an improved arrangement of the plates and mercury receiving pan. The sluice through which the pulp and water passes has a full width bottom opening adapted to receive a copper pan having inwardly extending and horizontal flanges at its sides, a cover plate resting on the flanges, and the plate being insulated from the pan. Spikes project from both the plate and the pan, there being in the pan a quantity of mercury, and means are provided for electrically charging the cover plates and pan.

LIGHTNING ARRESTER AND FUSE BLOCK.—Thomas L. Carleton, New Orleans, La. According to this improvement, the parts, after one operation, automatically place themselves in position for another operation, thus maintaining the circuit complete except at the instant of rupture by lightning or other cause. A pair of curved bars, one of insulating and the other of conducting material, are secured to a base, and shunts connect the insulating with the conducting bar, while an actuating bar resting against one of the shunts is capable of automatically passing to the next shunt on the destruction of the first, the metallic bar being connected with the line and the spring-pressed bar with the ground or line. A contact also engages with the arm after it has completed contacts with and destroyed all of the shunts.

Miscellaneous.

BOTTLE STOPPER.—Abraham L. A. Himmelwright, Middletown, Conn. The invention relates to an improvement in bottle stoppers, and the object of the invention is to provide a bottle stopper which will prevent the refilling of bottles by unscrupulous parties, who might replace the goods with inferior or counterfeit fluid and sell the same as the original contents and under the original label. In brief, the invention comprises a bottle stopper consisting of two sections mounted to slide longitudinally of one another, and of movable locking arms connected to one section and controlled by the other section to engage the bottle upon movement of one section in a predetermined direction, and means for preventing return movement of the said section.

BOOKBINDING.—John B. O'Riva, New York City. The object of the invention is to provide a binding for books which will be strong and durable, without necessitating the destruction of the grain in the leather used for binding. Heretofore it has been often necessary to so crimp and press the leather at the corners of book covers that the grain will be destroyed and the beauty of the binding very much impaired. The invention consists in a peculiar manner of constructing the binding, by which the corners are made as strong and durable as heretofore, and at the same time the grain of the leather is left in its original beauty. In brief, the improvement comprises a bookbinding corner having two flaps, one of which is folded inward and one edge of said flap being crimped against the main portion of the bookbinding, the remaining flap being folded over and secured above the crimped portion to hide the same.

SOLE AND HEEL SPRING FOR BOOTS OR SHOES.—George E. Swan, Beaver Dam, Wis. The invention relates to an improvement in springs for the soles and heels of boots and shoes, being especially adapted for application to the heels of footwear, and the object of the invention is to provide a spring pad or cushion which will serve to lift the heel of the boot or shoe as it leaves the pavement, road or other surface with which it is brought in contact, thereby preventing the shock or jar usually incident to walking on hard pavements or hard roads, and rendering the step easy, elastic and youthful. A further object of the invention is to provide a mechanical appliance to boots and shoes which will, in a great measure, compensate for the loss of elasticity in the cartilages of the knee and other joints incident to age. The invention consists of a spring tread for boots and shoes, in which the same consists of a strip of spring material bent upon itself to form a body or an attaching member, and a base member substantially parallel with the body member throughout a portion of its length, the free end of the base member being outwardly curved and carried in a direction to meet and pass the free end of the body or attaching member.

ADJUSTABLE BOOK SUPPORT.—David J. Wilson, Washington, D. C. The object of the invention is to provide an adjustable book support, designed to be screwed upon a desk or table and more especially intended for use in or by commercial houses, banks, record offices and similar institutions, for conveniently holding and manipulating ledgers and other heavy books, whose position the bookkeeper is required to frequently change in making the various entries and rulings thereon, obviating the necessity of using very high chairs and tilting the ledger on the edge of the desk in order to reach the top lines, which movement is very injurious to heavy books, and also obviating all moving and sliding of the ledger, as required in posting. In brief, the patent consists of a book support comprising a horizontal frame having parallel guide grooves or runways in the same, a sliding base moving in the same, a turntable mounted upon said base and a book holder mounted upon the turntable.

OPENER FOR ENVELOPES OR WRAPPERS FOR NEWSPAPERS OR THE LIKE.—Frank E. Munn, New York City. The invention relates to improvements in openers for envelopes, wrappers and the like, and has for its object to provide an opener of the character indicated, which is equally adapted for envelopes, newspaper wrappers, wrappers for boxes, parcels and packages of every description and boxes themselves. A further object of the invention is to provide an opener which will virtually form a portion of the envelope, wrapper or box, being so attached thereto that it can be readily grasped and drawn in direction of one or the other ends or sides of the envelope or wrapper, so as to sever the same and disclose the contents thereof without injury to the same. In brief, the invention consists of the combination with an envelope, wrapper or the like, of an opener, consisting of a fine wire, the main portion of which lies on the inside of the envelope or wrapper, each end of the wire being passed outside of the envelope or wrapper, then bent backward and passed inside of the same, and then again bent so as to run parallel with the main portion of the wire, whereby closed loops, consisting of three substantially parallel strands, are formed, the strands inclosing and lying close to the stock of the envelope or wrapper.

KNEADING AND ROLLING MACHINE.—William Dann Sprague, Black Mountain, North Carolina. This invention relates to improvements in that class of machines which are adapted for use in working dough, and the object of the invention is to produce a machine of the greatest simplicity, which is adapted to rapidly and efficiently knead and then roll dough, avoiding the necessity of working the dough with the hands, and, further, to construct a machine which is arranged so that it is not likely to get out of order and so that it may easily be kept clean. Another object of the invention is to produce a machine which manipulates the dough in much the same manner as it is worked by the hand, and which has its rollers adjustable so that they may bear upon the dough with the requisite pressure.

PRINTER'S ROLLER.—Benjamin Day, West Hoboken, N. J. This invention is for a flexible tube-form printer's roller, adapted to be put on and taken off the roller stock, the roller being of gelatinous material and having toughened surfaces inside and outside which protect the soluble flexible material in the body of the roller from the effects of moisture and air. The roller may be made of the ordinary roller composition, or for fine work is made of the finest gelatin and glycerin—one part of gelatin to two parts of glycerin—but the invention consists principally of the means of forming the roller with the least water in its composition, and the forming of an insoluble skin on its outer and inner surfaces.

MUSICAL INSTRUMENT. — Bruno E. Wollenhaupt, New York City. This improvement relates to former inventions of the same inventor, the invention being applicable to violins, violas, guitars, citheras, mandolins, etc., and being designed to greatly increase the volume and duration of the sound without rendering it more difficult to play the instrument. The shanks of graduated tuning forks are secured to a sounding support within the body of the instrument, the tuning forks being graduated according to a chromatic scale to form a sympathetic vibrating device, and sounding sympathetically and in unison with the corresponding strings played at the time by the performer.

CURTAIN POLE AND HANGER.—John H. Hilliker, New York City. This invention provides a superior curtain pole and fixtures, the curtain being mounted so that it may slide along the pole while being adjusted. The pole has a longitudinal slot in its under side, the slot being enlarged at the axial center of the pole, and an upwardly extending arm of a bracket secured to the window frame enters the slot. The curtain securing pins have at their upper ends a head fitting in the enlarged portion of the slot, the pins freely sliding in the slot. A cornice or ornament may be held in front of the pole by means of hooks on the pole and eyes on the rear of the cornice.

HOOK AND EYE. — John H. Akers, Washington, D. C. The hook, according to this invention, is made of a single piece of metal, bent in the middle to form attaching loops, while its ends are extended and bent over to form hooks converging toward each other to form spring jaws, and then turned away and bent outwardly to form locking recesses. The eye part has two eyes to receive the hooks, two shanks to pass between their spring jaws, and a cross loop adapted to lock in the recesses. This hook and eye will fasten the meeting edges of garments in an easy and secure manner, and the two members will not accidentally disconnect themselves when they are pressed together.

CAP.—Joseph Kornfeld, New York City. A cap which may be folded into small space without injury, which may be made very light, and which affords thorough ventilation, has been designed by this inventor. The body of the cap is formed of a series of sections, between which extend strips of perforated material, such as fibrous netting, the strips extending from the center to the lower edge, or extending entirely across the body, crossing each other at the center. The visor is preferably formed of a soft, pliable material.

NAPKIN HOLDER.—Nicholas F. Clarkson, New York City. This is a device by means of which the napkin may be conveniently held suspended from the neck, and which is adapted to hold the napkin when not in use, and rolled up. It consists of a back plate having a hook, while a transversely arched clamping plate has a hinged connection with the back plate at each side of the hook, a tongue extending through an opening in the shank of the hook to an engagement with a spring attached to the body portion of the back plate.

SHOE HOLDER.—Anthony B. Crocco, New York City. To hold a shoe in position to facilitate blacking and polishing it, this holder is made with two hinged last shaped parts, separated by a screw rod as in a shoe stretcher, to firmly engage the shoe, and the nut through which the screw rod passes affords a bearing for the end of a vertical screw rod in a suitable standard erected on a stand. The stand has a drawer for holding polishing and blacking tools, and the last parts can be opened or closed to fit any sized shoe, the shoe being readily turned to give the operator access to it on all sides.

SHOE.—David D. Toal, New York City. This is a shoe especially adapted for bicyclists and pedestrians, being designed to afford more than usual ventilation, and facilitate drying the stocking, should it become wet. The vamp of the shoe, just back of the toe cap, is made with two large tab portions, one crossing the other to form the covering for the top of the foot, the ends of these tab sections being extended to engagement with buckles or other fastenings at the sides of the ankle.

LAWN MOWER KNIFE SHARPENER.—Joseph J. Burke, Wilber, Neb. This is an easily manipulated machine of simple and durable construction, which permits a ready adjustment of the knife supporting device so as to always bring the cutting edge in proper relation to the grinding wheel to sharpen the knives very accurately. The invention consists principally of adjustable bearings or supports for the knives to be ground, a movable knife rest, and a revoluble grinding wheel, both rest and wheel being mounted on a longitudinally movable carriage.

FENCE. — James N. Young, Parma, Mich. This invention relates to wire fences having pickets attached to the wires of the fence, and provides a fence which is very strong, easy to erect, and adapted to withstand and compensate for the contraction and expansion of the fence wires. The post is formed of angular bent plate metal, strongly braced against longitudinal and lateral strains, and the pickets are readily placed on and secured to the fence wires by hook headed staples.

HAMMOCK.—Thomas J. Woodcock, Philadelphia, Pa. This hammock has the end of the material of which it is formed doubled on itself to form a loop from which the tabs are formed, and then doubled upon itself to form a hinged adjacent loop divided to form two pockets, one for a pillow and the other for a spreader. The pillow may be thrown back over the tabs and partially over the suspension cords to lengthen the hammock when necessary, and the spreader pocket forms the connection between the pillow and the body of the hammock, all being formed of a single piece of material.

BRACKET FOR SWINGING STAGES.—Henry Witzgall, Pittsburg, Pa. For use in connection with the swinging stages employed by painters, etc., this inventor provides brackets capable of ready attachment to the stirrups of the stages, the attachment being so made that the stage will be readily adjustable on its brackets, permitting the stage to be carried outward to clear projections of the building, while the brackets have cushioned rollers adapted for constant engagement with the face of the structure. The brackets are also so constructed that they hold the stage firmly in the adjusted position, enabling one to walk on it as on a permanent fixture.

TABLE. — Max Lesser, Boston, Mass. This is an article of furniture devised more especially for the use or convenience of invalids, and is designed to be readily secured to a bedstead or other suitable support. Its construction is such that it may be readily adjusted and changed to make it serviceable for a dining table, a table upon which games may be played, or for a reading and writing table. The top of the table has hinged sections and rotates on a standard which is vertically adjustable in a sleeve on which are opposite arms carrying clamping devices.

OIL STOVE. — Enos F. Depuy, Port Richmond, N. Y. The combustion chamber of this stove has slots in its bottom through which extend the wicks, and a grated platform extends above the open top of the chamber to support the culinary vessels, the latter being held sufficiently high to permit sufficient air to pass to the flame and effect complete combustion, preventing any smell of oil. The wick tube has an oil chamber connected by a pipe with an oil reservoir at one side of the casing.

SAFE ATTACHMENT.—Abraham Oberndorf, Jr., Centralia, Kan. This is an improvement on a former invention of the same inventor, in the nature of a portable attachment, which, when placed in a safe, vault, or strong room, will, in the event of an attempt to blow open the same, cause the generation of a stifling and poisonous gas, in which the burglar cannot live. A frame to be hung up or detachably fastened in the safe or vault forms a housing for a fanlike pneumatic trigger, which is acted upon by the concussion of the blast to trip a hammer and allow its descent from a spring to fracture a bottle containing the ingredients of poison vapors, allowing the poisonous gas to be generated and fill the safe or vault, so that to continue operations by the burglar would mean death or insensibility.

MECHANICAL MOTOR.—Archie D. Bryce, Lake City, Minn. This contemplates the use of an elastic cord in connection with pulleys or drums, the cord to be wound on one or more of the pulleys or drums and made to exert its tension in such manner as to become unwound from the first and wound on others, producing more power than may be ordinarily obtained in such manner. In a rectangular frame is a shaft carrying a cone with six concentric pulleys, there being a drum adjacent to the smaller end of the cone, and in the opposite end of the frame is a shaft on which is a cone. Fixed to the drum and to the largest pulley of the cone is an elastic cord, to be alternately wound on the drum or the pulleys of the cone, after being carried around the cone shaft in the opposite end of the frame.

BOTTLE STOPPER.—Wilber E. Cook, Middletown, N. Y. To prevent the refilling of a bottle and its use as an original package, this inventor provides a bottle with a double head, an inner and permanent head and a neck and outer head or hood, the latter being firmly connected with the former and the two so connected that the outer hood must be separated from the neck before the bottle can be opened, giving to the bottle an appearance very different from the original package. The outer hood and head may be readily separated from the neck and head proper of the bottle, but the hood or head cannot be replaced after the bottle has once been opened.

SUPPORTING AND MOVING INVALIDS.—Sewell S. Hepburn, Oliver, Va. To facilitate lifting and moving invalids to different points in a room this inventor has devised an apparatus which may be adjusted for use and taken down in a few minutes, and which comprises a sectional standard with clamping devices, a windlass of novel construction, and a hammock frame and hammock, the adjustments of which may be varied to a great extent. The hammock, suspended from its hanger, may be conveniently raised or lowered at its head or foot, as desired, and may be easily swung to any suitable position.

MOVABLE INDEX FOR RECORD BOOKS.—Bruce B. McCreight, Dubois, Pa. This invention comprises an index slip and a flexible guide having at

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each end means for attaching it to the sections of a book, the index slip having movement on the guide. The movable or duplicate index is adapted to be carried over the face of one or more pages, to temporarily locate the names, letters or figures at a point distant from where they are entered on the book, economizing time and lessening the chances of mistakes.

POTATO CUTTER.—Oscar A. Bulette, Seattle, Wash. This is a simple and easily operated device for cutting potatoes into longitudinal blocks. The blades of the cutter are so arranged that they will cut all sides of the blocks, insuring a uniform shape and avoiding feather edges, which have a tendency to crinkle or become too crisply cooked before the entire block has been perfectly cooked. The several parts of the device may be readily detached to facilitate thorough cleaning.

INKSTAND.—Francis B. Pratt, Canton, Miss. This inkstand has an ink well and a supply well, a feeder duct leading from the bottom of the ink well to the bottom of the supply well, while an air duct leads from the upper portion of the ink well to the supply well. A cup shaped plug, closed at the bottom and open at the top, and suited to hold a sponge, has a screw thread engagement with a flange in the upper end of the ink well, and by screwing the plug downward the ink is forced into the supply well. The inkstand is easily cleaned and filled, and but a small quantity of ink need be exposed at any time.

PLAYING CARDS.—Charles B. Rosenberger, Pittsburg, Pa. This invention provides a plurality of suits of cards, each suit having an identifying character common to all the cards in the same suit, and each card having scoring numerals, one for an identifying character without color thereon, and the other for the same and its color. The game affords two grades of chance, and a commensurate degree of remuneration for the winning player.

TEMPORARY BINDER.—Jos. W. Wood, Baraboo, Wis. This improvement comprises a back piece from the ends of which metal clips extend forward, each clip being curved to form a channel providing seats for a lacing cord which is woven back and forth through the clips in the channels. A simple and inexpensive binder is thus formed for pamphlets and newspapers, in which the back edges and bottom ends of the matter bound will be protected from abrasion.

MOLE TRAP.—Jacob W. Reger, Charles W. Denison and George D. Denison, Judson, Mo. In a U shaped frame whose pointed ends are adapted to be pressed into the earth at opposite sides of a runway is held a sliding trip rod, on whose lower end is a head which is made to rest on the earth directly over the runway. The mole, in passing, raises the earth slightly, when the trip rod releases a spring pressed follower, which carries prongs or teeth that pass into the runway and through the mole or other animal.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 10 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

THE PRIMARY FACTORS OF ORGANIC EVOLUTION. By E. D. Cope. Chicago: The Open Court Publishing Company. 1896. Pp. xvi, 547. Price $2.

This work by Prof. Cope is entitled to a far more extended review than we can possibly give it here. We hesitate, indeed, to say anything about the present book, feeling that a mere statement of its title and the author's name will be enough to give it standing. It is a very elegantly printed book, thoroughly indexed, elaborately illustrated, and is a valuable contribution to and presentation of the doctrine of evolution. Darwinism itself is in such a state of evolution, has been so modified by Weismannism, that what is known as a "New Darwinism" has been created, so that it really requires almost as much reading to keep pace with the modern science of evolution as with electricity or any other science. The author does not seem to be, by any means, a pronounced Weismannist. A cursory glance at the index inclines us to the belief that it is not very accurate in its paging.

AN EXAMINATION OF WEISMANNISM. By George John Romanes. Chicago: The Open Court Publishing Company. 1896. Pp. ix, 221. Price, paper 35 cents, cloth $1.

As a companion to Prof. Cope's book, we here have Weismannism critically examined by one who figures as having produced more effect on modern Darwinism than all others, probably, put together, and to those who desire to study modern evolution, perhaps the reading of both these books will be of value.

ON GERMINAL SELECTION AS A SOURCE OF DEFINITE VARIATION. By August Weismann. Chicago: The Open Court Publishing Company. 1896. Pp. xii, 61. Price 25 cents.

This paper was read in the first general meeting of the International Congress of Zoologists at Leyden on September 16, 1895, as we are informed in the preface. We have put it with the other two books to complete the series which they seem to form.

THE CENTURY SCIENCE SERIES. James Clerk Maxwell and Modern Physics. By R. T. Glazebrook. New York: Macmillan & Company. 1896. Pp. vi, 224. Price $1.25.

The students of the history of science have some favorite characters whose lives they are never tired of reading, either because of their interesting characters or because of their interesting work. Fleeming Jenkin is, perhaps, the most fortunate in his biographer, Robert Louis Stevenson having written a most graphic life of the scientist. Faraday and Maxwell form two kindred spirits whose lives will ever be favorites with all who admire the simple and gentle in humanity. As a supplement to the Campbell and Garnett more personal biography of Maxwell, the same publishers give us here, in brief, an account of his life in science and what he did in the scientific world. We have just reviewed several books on evolution, and it seems a little peculiar to find in them, as well as in this, no apparent reference to Maxwell's physical demonstration of the difficulties attendant upon the acceptance of Darwin's theory based on the probable size of the molecule. As a supplement to the life of Maxwell, the present book will be quite indispensable.

THE SUGAR FACTORY MANAGER'S HANDBOOK OF NOTES, TABLES, RULES, AND DATA. For managers, engineers, chemists, overseers, panboilers, and others engaged in the manufacture of cane sugar and the distillation of rum. By B. R. Body. Manchester: Office of the Sugar Cane. 1896. Pp. 78. Price $1.50.

This is one of those familiar little English books containing information relating to particular trades and businesses. It is written from the technical standpoint and can be recommended to sugar manufacturers and chemists as representing a most practical view of the subject.

VAN NOSTRAND'S SCIENCE SERIES. Sewerage and Sewage Purification. By M. N. Baker. New York: D. Van Nostrand & Company. 1896. Pp. iii, ii, 144.

This excellent little addition to Van Nostrand's Science Series is devoted particularly to the disposal of sewage from the American standpoint. It really relates as much to the laying of sewers as to the disposal works, and the disposal works themselves are very fully treated, the discussion of which is particularly to be commended.

AN ADVENTURE IN PHOTOGRAPHY. By Octave Thanet. Illustrated from photographs by the adventurers. New York: Charles Scribner's Sons. 1893. Pp. xi, 179. Price $1.50.

There are few brighter writers than Octave Thanet, and to our mind the authorship of this book is an excellent recommendation. It describes the author's adventures in the South with her camera, details her troubles and her successes, and throughout is replete with hints as to photographic processes. The work throughout is couched in most lively language, and whether one understands photography or not, is most excellent and lively reading. There are numerous illustrations, many of which serve as pegs on which to hang the story.

DOMESTIC SANITARY DRAINAGE AND PLUMBING. Lectures on practical sanitation delivered to plumbers, engineers and others in the Central Technical Institution, South Kensington, London, under the auspices of the City and Guilds of London Institute for the Advancement of Technical Education. By William R. Maguire. Second edition. New York: D. Van Nostrand Company. 1896. Pp. 475. Price $4.

Sanitary engineering from the scientific aspect is here excellently treated, for the book presents the practical application of scientific hydraulics to the plumbing of dwellings, and with much success. Instead of starting out with the practical presentation of its subject, the book opens with a reasonably good treatise on the elementary science, touches on the subject of the education of plumbers, passes on to sewage and sewage disposal, the rest of the work being devoted to sewerage and water supply. Throughout the plumber is kept in mind, and many useful hints may be gleaned by the workman of even many years' standing from the pages of this work. It has an index and a table of contents, is liberally illustrated, and is a tribute to the present desire of the public to have the best sanitary appliances in the dwelling house.

THE LOCOMOTIVE. Hartford, Conn. Published by the Hartford Steam Boiler Inspection and Insurance Company. New series. Vol. XVI. 1895. Pp. iii, 191.

The Locomotive is a trade publication and an example to all of how such a work can be conducted. It is a journal in which details of boiler accidents and explosions and much information in regard to boiler inspection, etc., are given; in which the practical points about boilers are discussed, and into which a considerable amount of interesting scientific matter relating to the subject finds its way. To our mind the journal is most interesting, and bound in book form, is a welcome addition to the library.

GESCHICHTE DER EXPLOSIVSTOFFE. Von S. J. von Romocki. II. Die rauchschwachen Pulver in ihrer Entwickelung bis zur Gegenwart. Mit vielen Abbildungen. Berlin: Robert Oppenheim (Gustav Schmidt). 1896. Pp. xi, 324. Price $4.

This second section of this work is devoted to smokeless powders, and really gives a most admirable treatment of the subject. Those conversant with the language need not be troubled with the German type in reading it, the Roman type used in this book being one of its merits.

CHEMISTRY AT A GLANCE. A study in molecular architecture. Issued in series. No. I. Oxides. By Herbert B. Tuttle. New York. 1896. Pp. 59. Price 60 cents.

This is the first of some ten successive publications designed to cover the field of chemistry. The author works almost entirely with graphic formulæ, and while this system of treating the subject is apt to lead one too far, yet the book, for a young chemist properly warned, will be, we believe, a most useful one, and will do a great deal to systematize his ideas. It will be easy enough for him to escape the danger of too great fixity by his work in the laboratory and his study of other books. Indeed, we believe that for the young chemist to start in this way, with chemistry as a purely mathematical science and then to find from investigation in the laboratory and in subsequent reading the numerous exceptions to the fixed theory which he will have formed, is perhaps the best and most useful way.

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Notes & Queries

HINTS TO CORRESPONDENTS.

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References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
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Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(6908) S. E. E. says: I would like to know, first, what is the proper dressing or polish to use on kangaroo and goat or kid shoes to keep them from cracking. Also the proper dressing for patent leather to prevent cracking. A. Add some olive oil to some pure wax which has been melted in a water bath and then add lard. Mix thoroughly by stirring over a moderate fire. Add oil of turpentine, then a little oil of lavender. This will form a paste which should be put in boxes. Apply with a linen rag. The paste keeps the leather soft and restores the gloss.

(6909) R. G. writes: I have been experimenting with thin films. Thus far I have failed to secure a soap bubble mixture that would produce a lasting film. Can you give me a formula for a good mixture? A. C. V. Boys, in his interesting work on soap bubbles, says, "Common yellow soap is better than fancy soap." The mixture we like best is made as follows: "Fill a clean stoppered bottle three-quarters full of pure water (distilled water preferred). Add one-fortieth part of its weigh of oleate of soda, which will probably float on the water. Leave it for a day, when the oleate of soda will be dissolved. Nearly fill up the bottle with pure glycerine and shake well. Leave the bottle stoppered for about a week in a dark place. Siphon off the clear liquid, add one or two drops of strong ammonia to every pint of the liquid. Use the mixture from a small working bottle. Do not get out the stock bottle every time a bubble is to be blown. Do not warm or filter the mixture." This mixture will keep for a year or so.

(6910) E. McD. asks: Can you inform me how to prepare a slide of crystals of iodosulphate of quinine for microscopical examination? A. Mix 3 drachms of pure acetic acid with one drachm of alcohol, add 6 drops of diluted sulphuric acid (1 part acid, 9 parts water). Place one drop of this fluid on a glass slide and add a minute particle of quinine. After this has dissolved add a very small drop of tincture of iodine by means of a fine glass rod. After a time, chemical action ceases and the crystals begin to form slowly, without heat. These crystals are beautiful in polarized light.

(6911) J. D. asks (1) the meaning of ampere turns. A. The product of the amperes passing through a wire multiplied by the number of complete circles made by such wire. 2. Name some good open circuit batteries. A. The Leclanche is standard. Dry batteries are also excellent. For batteries see our SUPPLEMENT, Nos. 157, 158, 159, 792. 3. Where can I get catalogne of small electrical apparatus? A. Address any of our advertisers of electrical goods. 4. Name SUPPLEMENT number with simple ammeter and voltmeters. A. There are no really simple ones. For examples see our SUPPLEMENT, Nos. 652, 563, 618, 628, 668, 353, 734. 5. How many grains of copper does one ampere deposit? A. 0·33 milligramme per second. 6. Is T. A. Edison a college graduate? A. No. 7. Name SUPPLEMENT number with induction coils. A. Nos. 160, 569, 229.

(6912) A. J. E. writes: 1. Constructed as directed, which of the two motors, 759 and 641, would give more power? A. The motor of SUPPLEMENT, No 759, is the more powerful. 2. Could motor 641 be wound so as to furnish ½ horse power, with two cells of Edison-Lalande batteries? A. No. 3. For a drum armature would disks of tin answer as well as carriage washers or punchings? A. Disks of sheet tin would answer, as this is simply tin-plated sheet iron. 4. Are the disks insulated from the shaft in a drum armature? A. They need not be. 5. Which is better for the fields of motor 641: (a) the laminated sheet iron as shown, (b) cast iron fields, or (c) fields made up of a piece of wrought iron ½ inch thick? A. For even cross section the solid wrought iron field is slightly the better.

(6913) S. & T. write: We wrote you about length and size of wire for resistance for Plante storage cells. You gave iron wire 10–12, but did not know potential or current. The dynamo is 110 volt current and is made to run 100–110 volt lamps. Is the number of lamps the machine is able to light the potential? A. There is no such thing as a 110 volt current. Potential is expressed in volts, current in amperes. You require about 50 amperes of current for 100 16 candle power 110 volt lamps. A No. 5 or even No. 6 copper wire would carry this—a No. 0 or No. 00 iron wire. The amount a wire will carry varies with its surroundings. If exposed to the air, it will carry more without dangerous heating than if insulated and tightly wound. The smaller iron wire would be quite large enough, if wound in a loose spiral. The potential of the machine gives the voltage of the lamps proper to go with it.

(6914) F. A. McL. asks how many vibrations it takes to produce the lowest note on a piano, say A, and if they increase regularly or not. That is, does each note increase with the same number of vibrations of its neighbor? Do every two notes differ with the same number of vibrations as you go up the scale? What is the number of vibrations to produce each of the notes of the piano keyboard? A. The middle C is taken generally as corresponding to 256 double vibrations per second. C one octave below has one-half this number of vibrations, C one octave above has double, two above four times and so on. Then for the musical scale, taking C as unit, the other notes are represented by fractions, as C=1, C sharp=$\frac{25}{24}$, D flat=$\frac{27}{25}$, D=$\frac{9}{8}$, D sharp=$\frac{75}{64}$, E flat=$\frac{6}{5}$, E=$\frac{5}{4}$, etc. Thus to get the number of vibrations in any of the above in the octave above middle C, multiply 256 by the fraction. All this is subject to variations in the standard pitch. Thus the French standard middle C has 261, the English 256 double vibrations. The lowest audible note is about 16 per second; under some conditions it is claimed that 9 vibrations per second have been audible. On some grand pianos A with 27½ vibrations per second is included on the keyboard, and the range may go up to A^{iv} with 3520 or C^{v} with 4224 vibrations per second. The intervals between notes are expressed by fractions, thus: C to D $\frac{9}{8}$, D to $E\flat$, E to F $\frac{16}{15}$, etc., each interval being the quotient of the ratio of the lower divided by the ratio of the higher note.

(6915) W. asks: 1. Approximately, what would be the dimensions of permanent magnets, giving an output of three or four 16 candle power lamps—alternating current? A. This question cannot be answered without knowing the quality of the magnets and voltage of lamps. You would need 20 square inches of pole area and 2,500 turns of No. 18 wire on the armature, taking low excitation of the magnetic circuit. 2. Driven by the same power, how many more 16 candle power lamps would an alternator furnish over a direct current machine? The fields being excited by a separate dynamo, the above power being figured on the basis of one-half horse. A. There should be little or no difference. 3. Will the power or current required to excite the fields equal the additional lights in the above? A. You cannot escape using power to excite fields, whether derived from an outside source or from the dynamo itself. 4. Would it not be better in small plants to use the alternatormore extensively, of course double winding the armature, for current to excite the fields? Would there not be less fluctuation in the lights with the variations of the power, and would not less trouble be experienced in general management of dynamo and lights? A. Each type of generator and plant has its own advantages and disadvantages. The direct current is more convenient in some ways and is less liable to give bad shocks.

(6916) H. V. S. asks how to prepare a simplex or a hektograph for producing copies of letters. A. Our SUPPLEMENT, No. 438, contains an illustrated description with full details of the hektograph. We can supply it by mail for 10 cents.

(6917) E. A. B. says: There is a preparation being sold by parties in different parts of the country, which, in solution, will preserve quite perfectly fruits and vegetables immersed in the solution and kept covered by it, sealing not being necessary. Can you tell me what this preparation is, and how to make it, or where to procure it in bulk? A. Use only fruits and vegetables which are thoroughly sound. The fruit or vegetables may be washed if desired. The fruit may be packed in jars, crocks, or kegs as desired. Put it in as closely as possible without injuring the fruit, as the more compact it is packed the smaller will be the quantity of liquid required to cover it. Take two ounces of salicylic acid and twenty-five pounds of sugar (coffee C); the acid and the sugar are dissolved in 6½ to 7 gallons of hot water. See that both the sugar and acid are all perfectly dissolved, let the solution get cold and then pour on enough of the liquid to cover the fruit. The top of the vessel should be covered, but need not be sealed. The quantity of sugar is usually sufficient to make the fruit sweet enough for table use. The quantity of liquid named above is sufficient to cover about twenty-five gallons of fruit. For preserving pease, beans, tomatoes, sweet corn, pickles, etc., the quantity of acid remains the same, but twenty ounces of sodium chloride (common salt) are added and the quantity of hot water is reduced to five gallons; proceed as before. When cold, the vegetables can be covered with the liquid. It is very essential to see that the fruit or vegetables are completely covered by the solution at all times. Any fruit found floating on the top should be promptly removed, as it would tend to contaminate the contents of the vessel. If it is found that the solution is evaporating, more of the liquid should be added. It is perhaps as well to have the crocks, etc., have

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covers which fit tight enough to prevent evaporation of the contents. All medical authorities do not consider that this process of preserving fruit by salicylic acid is healthy.

(6918) G. K. D. says: I write to ask if you can furnish me with the approximate formula (as exact as possible) of the composition used for making the Swedish safety matches, both the composition in the head of the match and the composition of the coating on the box on which the match is struck. I refer to safety matches in general, not especially to the Swedish make, although that is a very good sample. A. 1. Dip the splints in a paste composed of chlorate of potash, 6 parts; sulphide of antimony, 2 to 3 parts; glue, weighed dry, 1 part. The paste for the rubbing surface is amorphous phosphorus, 10 parts; oxide of manganese or sulphide of antimony, 8 parts; glue, 3 to 6 parts, weighed dry. The ingredients must be thoroughly mixed and care must be taken not to mix the chlorate of potash in the dry state with the other materials; it should be mixed first with the glue dissolved in warm water. The paste for the rubbing surface may be spread with a brush or spatula on the side of the box. 2. Glue, 16 parts; chrome yellow, 2 parts; oxide of iron, 2 parts; peroxide of manganese, 24 parts; hyposulphite of lead, 8 parts; and chlorate of potash, 36 parts. Composition for the box.—Hyposulphite of lead, 260 parts; chlorate of potash, 14 parts; oxide of iron, 7 parts; powdered glass, 8 parts; finest glue, 4 parts; and amorphous phosphorus, 24 parts. Glue is dissolved in water; other ingredients, being in powder, are afterward mixed with it to the consistence of paint and applied with a brush to the surface of the box.

(6919) G. M. asks (1) whether in the manufacture of calcium, carbide for the production of acetylene gas, charcoal can be substituted for coal, in regions where wood is abundant and coal is scarce. A. Charcoal probably could be substituted for coal, but the economy of so doing, and its practicability, would have to be the subject of experiment. 2. Can fuel gas be made directly from wood or charcoal, the same as from coal in circumstances as described above? If so, where can I find a description of the process? A. Yes; wood, on account of the hydrogen contained, would work better perhaps than charcoal, and certainly much more economically, as it would avoid the loss of heating constituents incidental to the manufacture of charcoal. 3. Where can I find a description of the process for the manufacture of wood pulp for paper making? A. See SUPPLEMENT, Nos. 732, 733, 734, 848, 872, 937, 951, 959, 960, and 982, for valuable data. 4. What numbers of the SCIENTIFIC AMERICAN SUPPLEMENT contain an account of the electrical exhibition recently held in New York? A. Nos. 19, 20, 21, and 22, vol. 74.

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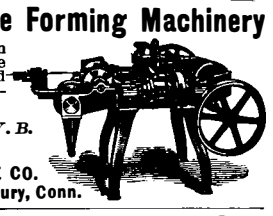

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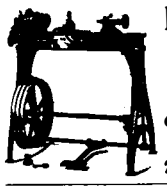

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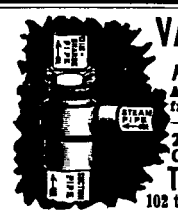

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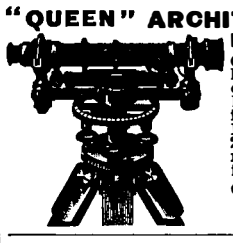

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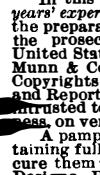

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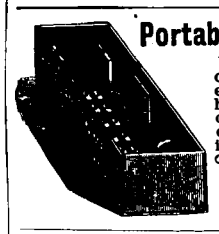

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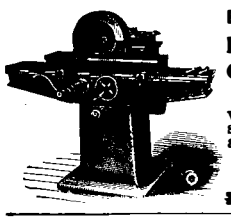

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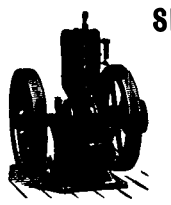

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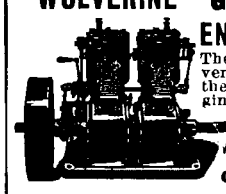

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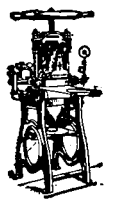

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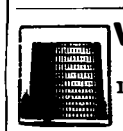

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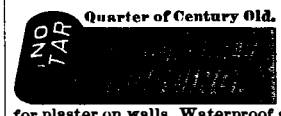

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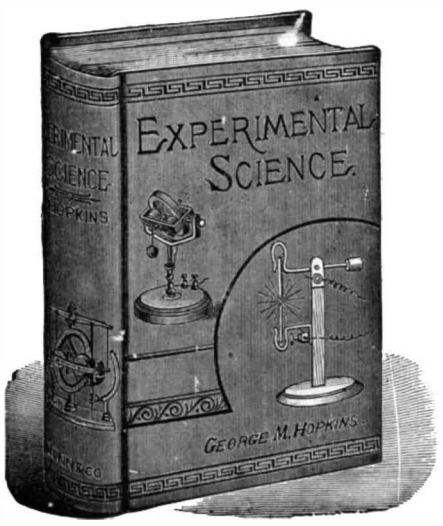

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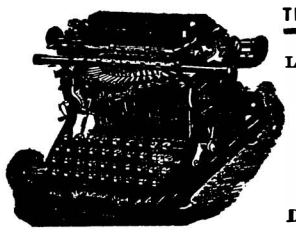

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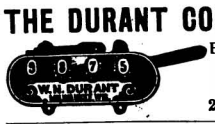

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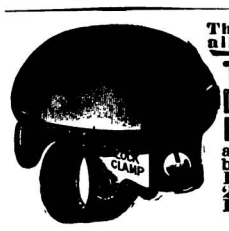

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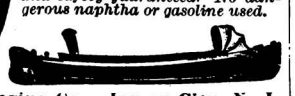

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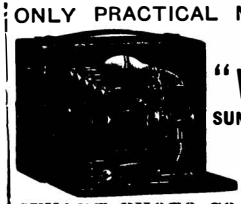

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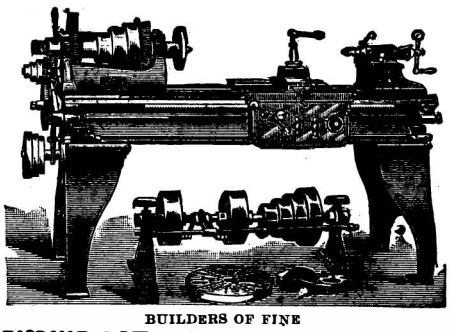

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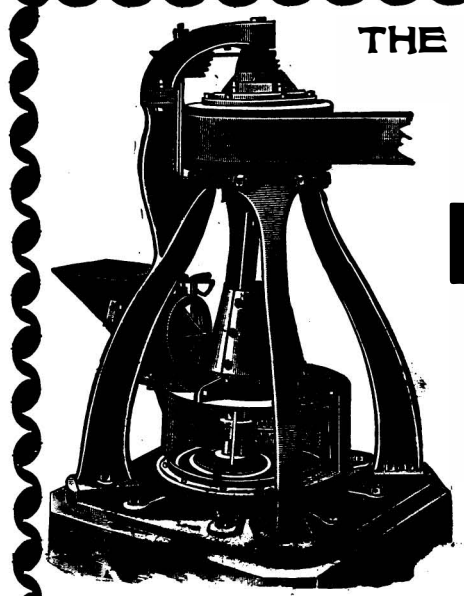

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